LIBRARY OF CONGRESS
Jul. 8.6.4
FEB 26 1890
SMITHSONIAN DEPOSIT

THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY,N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LII.—No. 8. Whole No. 768. | NEW YORK, MONDAY, FEBRUARY 24, 1890. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N.Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Ohio Gas Light Association..... 241

EDITORIALS—
Briefly Told..... 241
Tidings from the New England Meeting—Annual Meeting, Clinton, Mass.—Personal—Annual Report, Supt. of Public Lamps, Boston, Mass.
The Market for Gas Securities..... 242
*The Northwich Gasholder on Messrs. Gadd and Mason's Principle, by Thomas Newbigging, C.E..... 243
Claus' Method of Producing Water Gas, and Obtaining Hydrogen, Carbonic Oxide or Carbonic Acid, and Certain Bye-Products..... 244
The Massachusetts Board of Gas and Electric Light Commissioners on the Subject of Water Gas..... 245
Annual Meeting, Waltham (Mass.) Gas Light Company..... 247
Twentieth Annual Meeting, New England Association of Gas Engineers—Official Report, Revised by the Secretary..... 248
First Day, Morning Session: Committee on Invitations—Disposing of the Minutes—Applications for and Election to Membership—Resignation of Mr. Jas. Porter—Letters of Regret—Roll Call.
The Proposed Hatteras Light..... 249
Preventing the Incrustation of Boilers..... 249
The Connellsville Coke Trade..... 249
Profit in Gas Making..... 250
Tinting Incandescent Lamp Bulbs..... 251
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 251
Refusing to Sell the Downington (Pa.) Gas and Water Works—Public Lighting, Centralia, Wash.—Cheaper Gas for Steubenville, O.—Defective Service Pipes, Philadelphia, Pa.—The Holtzer-Cabot Company does not Infringe—Sale of the Batavia (N.Y.) Gas Company—Massachusetts Gas Companies may Pay Dividends in Excess of 10 per Cent.—Annual Meeting, Natick, Mass.—Electric Light Shut Down at Napa, Cal.—Annual Meeting, Portsmouth, N. H.—Prof. Ely on Gas Companies and Taxation—The Freeport (Pa.) Works Shut Down—Changes at the Fayetteville (N. C.) Works—Annual Meeting, Jefferson City, Mo.—Mr. McMillin on Fuel Gas for St. Louis—Annual Meeting, New York and Cleveland Gas Coal Company—Complaint against Consolidated (N. Y.) Company—The Duties of Buffalo's Gas Inspector—Regulating the Purity of Rhode Island Gas—Annual Meeting, Salem, Mass.—Electric Rates at Martinsburg, W. Va.—Annual Meeting, Lawrence, Mass.—Public Lighting, San Jose, Cal.

[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY,
COLUMBUS, O., January 20, 1890.

To Members of the Ohio Gas Light Association:

Gentlemen—The Sixth Annual Meeting of this Association will be held at Toledo, O., on March 19 and 20, 1890.

This announcement is made thus early in order that all members may be reminded of the meeting in ample time to make their arrangements to be present. Every member is urged not only to attend this meeting, but also to interest himself in inducing others of his acquaintance who are eligible for membership, but who have not as yet joined the Association, to come to the meeting and become members.

It is not intended that as many papers as usual shall be presented at the forthcoming meeting, in order that more time than formerly may be had for the discussion of those that are read, and for such other matters and business as the members may desire to dwell upon.

Although the Secretary has for some time been engaged in the work of soliciting papers for this meeting, he has not yet secured as many as should be had, notwithstanding fewer are desired than heretofore, and he therefore earnestly calls upon all members who can possibly do so to notify him immediately of their willingness to furnish papers.

It has been decided that an interesting and valuable feature of our meeting would be a "Question Box," in which members can place questions, which will be withdrawn and read to the meeting and answered and discussed by the members. Every member is requested to send to the Secretary at once any question or questions which he would like to have thus brought before the meeting.

Future circulars will announce further details concerning the meeting.

Respectfully, IRVIN BUTTERWORTH, Sec'y.

BRIEFLY TOLD.

TIDINGS FROM THE NEW ENGLAND MEETING.—"*Boston, Mass.*, Feb. 19, 1890.—Those who were in Boston on the evening of last Tuesday, were inclined to be alarmed over the unusual atmospheric conditions that prevailed—conditions that were abnormal even in connection with or contrasted to those that have ruled in this oddest of Eastern winters. Hail, snow, lightning and thunder, are not often felt, seen or heard, at one and the same moment; but that melange was served up in Boston at 10 P.M. of the 18th inst. But those within the walls of Young's—and many a gas man had already visited the clerk and confided his grip to 'front,' 'ere the lightning flashed and the thunder crashed—cared nought for the weather. And why should they? Turning that question over to the custody of any who feels that he can answer it, I may say a decidedly loud whisper was in the corridor that Secretary Nettleton would be an absentee. This was a bit of a damper; for he has become such part and parcel of the Association in general, and the Secretary's desk in particular, that his good offices have assumed the nature of a staff. Sure enough, next morning, when in precise and trained tones Chairman Taber opened the way for business, the man from Bir-

mingham was absent. The Moses selected to show the route in respect to the Secretary's duties was no less a party than Mr. Humphreys, of Lawrence, wherefore I am led to remark that Nettleton was worthily represented. Mr. Nettleton had hoped to be back in time from a visit to the far West, as he had been hastily summoned to Grand Island, Nebraska, but it was not to be. Hastily noting that the melange of Tuesday evening was followed by clear, cool weather to-day, it is with great satisfaction I note the presence of a goodly assemblage of delegates. As is usual with the New England Association, no time was wasted in formalities, but steadily guided by the rythmic rulings of President Taber, the order was proceeded with. One other notable thing in connection with the attendance was the presence of Honorary Members Vanderpool, Benson and Thomas, whose attendance made all the more noticeable or pronounced the absence of many whom the Association was wont to greet with favor. To report the regular business, however, is perhaps more what you and your readers desire than what has so far been written here; and with that as a guide, I can have nothing but praise for President Taber's address, although I am not entirely at one with him over some of his conclusions in respect to electric lighting. Scholarly and precise as is the usual manner of diction employed by Mr. Taber, I must say that a more beautifully rendered tribute to the memory of a dead companion or associate I have never listened to than that poured forth by President Taber over the late Mr. Cushing, of Lowell. Beauty of wording marked the tribute; depth of sentiment perfumed it, and truthfulness leavened it. Having for years been a close personal friend of deceased, I may be pardoned for this extended reference to Mr. Taber's expression of thought respecting that friend. And I know that as I feel about this sad event, so do the others of the New England Association who were privileged to call Cushing their friend. As a whole, Mr. Taber's address was of the quality that might be expected from him. He does not beg questions, but answers them. The paper list carried out its promise fully, and I must say also that Pratt's contribution completely verified the promise raised by its title. If all handsome bindings but inclosed similar 'meat,' you could always be safe in 'judging a book by its cover.' Not having at this hour heard Mr. Goodno's paper read, I am in the dark as to whether a like verdict shall apply to it; but it is quite safe to say that it shall, for Goodno is thought pretty well of 'out this way.' Of course I could not take such liberty, unsheltered from the cloak of a name that shelters one in an expression of opinion; and I assure you that many of the Eastern fraternity would like to know who 'Observer' really is. It was expected that Dr. Amory would handle his subject well; and the Doctor justified the expectation to the letter. There can be no doubt that his remarks anent the "Municipal Control of Gas and Electric Light Companies" will have close attention from your readers. Slater—another man who never begs the question, since he always answers it—told in his usual clear style about "Why I shall Make Water Gas." New Bedford seems to be especially favored in that the 'second string to its bow' at this meeting—Mr. N. W. Gifford—was in high unison with his fellow. His "Some Experiments in the Photometer Room" will likely be repeated by others when they understand how the New Bedford ones were conducted. I did not intend to make such extended reference to the papers, but their merit and importance are the excuse that I offer. Before closing this portion of my subject I should be decidedly amiss were I not to make mention of President Taber's manly utterances in respect to the value and worth of the Massachusetts Board of Gas and Electric Light Commissioners. He is all the more to be commended for this, since, if I greatly mistake not, he was not originally a supporter of the movement that resulted in the creation of the Board. However, it is New Bedford policy, as a rule, to wait until a thing has been tested ere New Bedford gives an opinion—a safe rule, too, it may be set down to be. The officers chosen to serve for the current year are:

President—Chas. F. Prichard, Lynn, Mass.

Vice-Presidents—Horace A. Allyn, Cambridge, Mass., and Wm. A. Wood, Boston, Mass.

Secretary and Treasurer—Chas. H. Nettleton, Birmingham, Conn.

Directors—Edward C. Jones, Henry B. Leach, Z. M. Jenks, Wm. Badger and E. C. Learned.

While the applications for membership this year were on the small side, it is nevertheless a fact that the available ones outside the rolls of the Association are not in very great numbers.

To-night we hold carnival in the banquet hall. That pleasure awaits us cannot be successfully denied. To-morrow it is likely that the members will inspect the plants of the Bay State Company, an invitation to that effect, extended by Mr. J. Edward Addicks, having been accepted by the Association. It does not seem necessary that I should say the meeting is a success, but I, nevertheless, must say that such is the case.—OBSERVER."

"*Thursday*, Feb. 19.—The banquet proved a most enjoyable affair, and the business proceedings of to-day, which were carried out with dispatch, were more than ordinarily interesting to gas men. The proposed visit to the works of the Bay State Gas Company, however, had to be abandoned, a heavy snow fall, that set in early this morning, putting comfortable moving about in carriages out of the question. It is likely that some of the members will visit Waltham to-morrow, there to inspect the fuel gas plant in operation at the great watch factory. I have but time to add that the meeting marking the end of the Association's second decade was both brilliant and valuable.—OBSERVER."

ANNUAL MEETING, CLINTON, MASS.—At the annual meeting of the Clinton Gas Light Company, held on the 18th inst., the following officers were elected: President, Eli Forbes; Treasurer. Clerk and General Manager, Henry N. Bigelow. Directors, Eli Forbes, Henry N. Bigelow, Herbert Parker, John R. Foster and John E. Thayer; Superintendent, W. H. Spaulding. A reduction in gas rates (amounting to about 5 per cent. on the present schedule) was ordered. This places the prices at the following: Gross to ordinary users, $2.50 per 1,000; net, $2.25; other consumers, $2 per 1,000. Extensive betterments have been made to the Company's electric plant within the last three months.

PERSONAL.—We regret to have to announce the death, at her home in Albany, N. Y., on the morning of Sunday, 16th inst., of Emeline Griffin, wife of Noel E. Sisson.

ANNUAL REPORT, SUPT. OF PUBLIC LAMPS BOSTON, MASS.—We are indebted to Supt. Geo. H. Allen, for a copy of his report respecting the operations of the Boston Public Lighting Department during 1889. From the figures presented we find that there are 9,958 public gas lamps in use, to which must be added 798 high power arcs, 300 oil lamps, and 48 naphtha lamps. The Lamp Department employs 161 men, of which 151 are allotted to the lamplighting corps. The cost for the lighting is appended:

Electric lamps	$180,895.96
Gas lamps	229,061.54
Oil lamps	6,201.91
Naphtha lamps	1,411.90

The cost of lighting, extinguishing and repairs is returned at $127,256.15, and the total expenditure on department account for the year is reported to have been $593,798.23. The gas lamp contracts run until July 2, 1894, and the burning table calls for a lighting service covering 3,828 hours per annum. The burners used are fitted with an automatic regulator, and consume gas at the rate of 4 cubic feet per hour. It is also shown that the city now maintains "80 large gas lanterns," consuming from 15 to 30 cubic feet of gas per hour; but these do not seem to grow in favor, for, quoting from the language of the report, that as "the first cost of these lanterns is about $40, and as the expense of maintenance is very large, it would be of advantage to substitute the electric light for them at an early day, provided it can be accomplished without materially increasing the expenses of the department." The total quantity of gas consumed in the lamps was 158,946,216 cubic feet, which was supplied by eight different companies, and the average cost of the supply for the entire district is $1.453 per 1,000 cubic feet. The Boston Company proper charges $1 per 1,000.

SOME of the storekeepers of Brooklyn (notably Baldwin, the clothier, and Wilson's restaurant proprietors) have already abandoned the use of incandescent electric lamps supplied with current from the Brooklyn Edison central station. The service was found by them to be fully twice as expensive as gas; hence the change. The ruling gas rate in Brooklyn is $1.60 per 1,000 cubic feet.

The Market for Gas Securities.

The city market for gas shares shows no change, unless it may be said to have shared, in common with the market for railroad securities, in the weakness of the demand from investors, whose dividends have evi dently been placed. Consolidated is at 96 bid, which shows that even a weak general market has no power to affect it greatly. Mutual is up to 109, and it would not surprise us to see it go higher. Brooklyn shares are steady to strong. Baltimore Consolidated is weak, probably on realizing sales; and Chicago Trusts are lower. Laclede common is offered at 15. Eastern shares are all in the line of higher figures, and this observation applies with great force to the Massachusetts companies. Can it be that the State Gas Commission is partly responsible for the feeling of security that prevails among shareholders there?

The Northwich Gasholder on Messrs. Gadd and Mason's Principle.

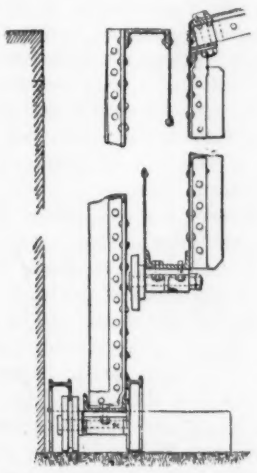
By THOMAS NEWBIGGING, C.E., in the London *Journal*.

Since the reading of my paper before the Manchester District Institution of Gas Engineers, at the meeting held at Doncaster about 18 months ago, at which the invention of Mr. Gadd was first prominently introduced and described, down to the present time, I have resisted the temptation to speak or write at length on the subject, believing that the best illustration of the value of the invention which is so great an innovation on all that has previously been suggested or attempted in this direction, would be its presentation in the shape of a practical working example.

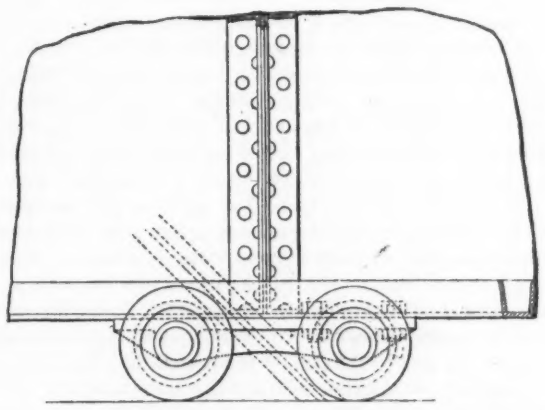
Now that the new principle of guiding has become an accomplished fact in the holder that has just been completed and put to work at Northwich, it is neither necessary nor desirable that I should longer refrain from a detailed reference to the merits of the new system. The best form this can take at present is obviously that of giving a full description, with illustrations of the holder.

The vessel is telescopic, in two lifts, each 20 feet deep. The diameter of the outer or lower lift is 60 feet; and of the inner or upper lift, 58 feet. The average diameter is therefore 59 feet. The height to which it rises when fully inflated is about 38 feet; the total height of 40 feet being reduced by the cup and grip and the bottom seal.

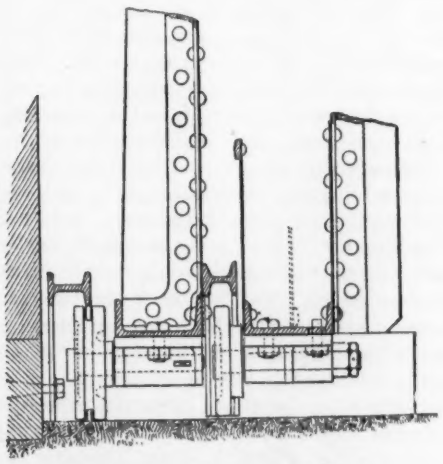
The top curb of the inner lift consists of two angle-iron rings 4 in. by 3½ in. by ⅜ in., and 5 in. by 3½ in. by ⅜ in. The roof framing is of the usual kind, consisting of a series of main rafters, 3 in. by 4 in. by ¼ in., trussed on the bowstring principle, secured to the curb at the outer end, and at the other end to the center or crown plates at the head of the king post.



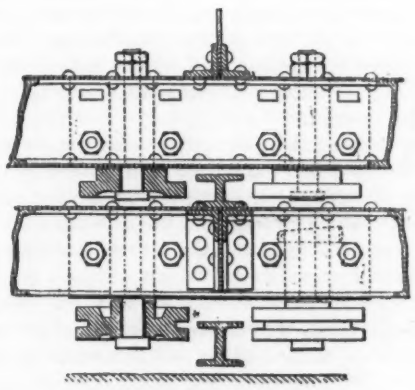
Section through Cup and Grip.



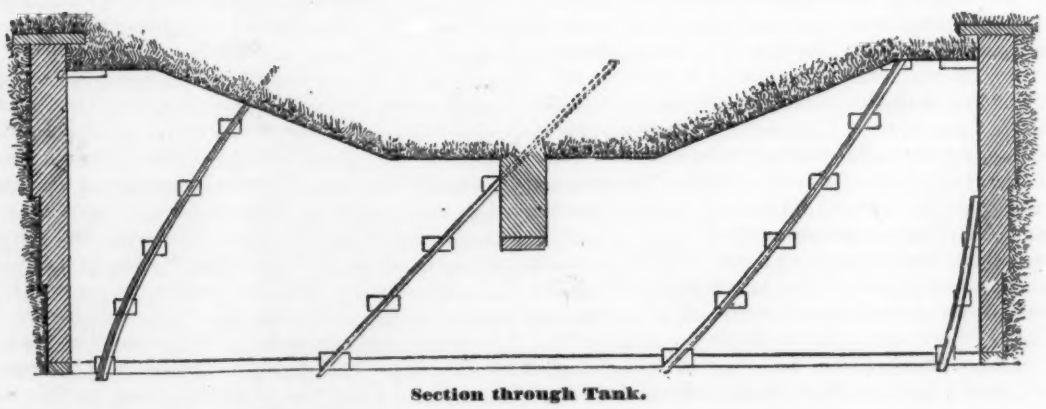
Elevation of Carriage.



Section through Cup and Curb.



Plan of Carriages



Section through Tank.

The secondary rafters are of flat iron, 3½ in. by ¼ in. The main tie rods are 1⅝ in. diameter. There are 16 vertical stays, each of 3 in. by 3 in. by ⅜ in. angle irons, with a piece of ⅜ in. plate riveted between in the inner lift. The hydraulic cup and grip are of the usual construction, 18 in. deep by 8 in. wide. The vertical stays of the outer lift are also 16 in number, one-half of them being made rather stronger than the other, and are ranged on the outside of the vessel, so as to admit of the guide rails being placed inside. The bottom curb is of channel iron, 8 in. by 3 in. by ⅜ in., and projects from the holder towards the tank. This curb, for single-lift holders, would answer equally well if placed inside; and even in telescoped vessels its adaptation in this way is possible. The

roof sheets are 10, 12 and 14 B. W.G. The holder is surmounted by a handrailing 2 feet in height.

I have been thus precise in describing the holder in order to show that the details throughout are substantially those of other holders guided in the ordinary way; the only difference being that the trussing is heavier than is usually adopted. I am now perfectly satisfied, however, that any additional strength or weight in this particular was quite unnecessary; and from the experience I have gained should have no hesitation in designing and constructing a holder to be guided under the changed conditions of materials as light as, or even lighter than, those of one guided on the old principle.

And now as to the guiding arrangements, which form the new departure. They are of the simplest character (which indeed is their chief merit), and require but little description. They consist for the outer lift of eight steel rails of H section, 4 in. by 3 in. by ½ in., placed against the tank wall at an angle of 45°, and attached to the coping of the tank, and at four other equidistant points in their length by jagged bolts let into stones built into the brickwork. The rails for guiding the inner lift are the same in number, and nearly the same in section—3 in. by 3 in. by ½ in.—the web being shorter, placed at the same angle, riveted at distances of 12 inches apart to the side sheets, to the vertical stays at the point of intersection, and secured top and bottom by means of lugs to the grip and curb respectively. The guide-rollers, one on each side of each rail, are of steel, and are 10 inches in diameter, revolving on 2-in. wrought iron axles, attached to cast iron carriages bolted to the bottom curb on the outer lift, and to the cup of the inner lift. The rollers on the latter work within the channel against the web; and the former, which are grooved, clip the outer table of the rails. These several details are shown in the accompanying illustrations, and will be readily understood. In the next holder of the kind a few modifications—chiefly in the method of fixing the guide-rails and carriages—will be introduced. It will thus be evident that in rising and descending the vessel has a helical or screw-like movement, and turns, in the course of its ascent to its full height, a distance of one-fifth of its circumference. The full pressure given by the holder is 7 inches; and by the bottom lift, 4½ inches. There is scarcely any perceptible difference in the indicated pressure during the ascent and descent.

The actual saving in weight of the total structure, as compared to what would have obtained had the holder been guided by upper framing composed of eight wrought iron standards having cast iron base plates, and braced with lattice girders, and the necessary wind ties, is 36 tons. The slightly increased weight in the bottom curb and spiral rails in the lower lift, does not exceed 2 tons, which will be a deduction from the above. What the cost of the additional material for the upper guide framing, finished and erected, would have been can therefore be easily reckoned. It amounts to at least £600; and this sum may be taken as representing the saving, at current prices, which is effected in the practical application of Mr. Gadd's invention to the comparatively small structure under consideration. It is to be remembered, also, that the tank being built without the usual brick piers and heavy base stones for standards or columns, necessarily costs less than one having these additions.

The contractors for the holder (Messrs. Clayton, Son & Co., Limited, of Leeds) experienced but little difficulty in bending the rails to the peculiar curvature (resembling that of a winding stair rail) which they had to assume, or in the attachment of them to the sides of the tank and holder. Certainly, if any slight difficulty did present itself in regard to these it will disappear in carrying out future work of the kind.

I have elsewhere remarked that in applying the principle to a two-lift holder of only 60 feet diameter, each lift being 20 feet high, or, together, two-thirds of the diameter, the test to which the invention has been put is a tolerably severe one. The conditions of stability in a holder of, say, 200 feet in diameter in three lifts of 40 feet each, are palpably superior by a difference of 10 per cent. to those which obtain in the present structure. In other words, if the two lifts in the Northwich holder were reduced from 20 feet to 18 feet in height each, the comparison would be equal—though, of course, it may be argued that the wind pressure at the higher altitude is usually stronger.

The Northwich holder, whilst inflated with gas to a height of 30 feet, has already been tested under stress of a series of strong gales which have occurred, and it has not shown any movement worth recording. Of the stability of the structure under any wind strain to which it is liable to be subjected, I have no doubt whatever; and I am convinced that the more closely the principle of its action is investigated and studied the more evident it will appear that, as compared with the old method of gasholder guiding, the new system, for efficiency, economy and beauty, takes a vast stride forward.

Claus' Method of Producing Water Gas, and Obtaining Hydrogen, Carbonic Oxide or Carbonic Acid, and Certain Bye Products.

According to the London *Journal*, English Letters Patent (No. 50, Jan. 1, 1889,) have been granted to C. F. Claus, of Suffolk House, London, for a method of securing the results outlined in the above heading. Our authority states that the somewhat lengthy specification of this invention is not accompanied by drawings of the plant proposed to be employed in carrying it out. The patentee explains that the gaseous mixture (consisting principally of carbonic acid, carbonic oxide, and hydrogen) commonly called "water gas," and which is now produced extensively by various methods, forms the basis from which he obtains, by the processes now to be described, hydrogen, carbonic acid, and carbonic oxide, each separately, and in a more or less pure condition. The water gas for his purposes can, of course, be manufactured in some other manner; but he prefers to produce it by the means claimed in the present invention.

He passes an uniform and continuous stream of highly superheated steam through a deep layer of fuel—preferably smokeless fuel, such as coke or anthracite—whereby the water or steam is decomposed, and forms, according to the depth of the layer of fuel or the temperature of the incoming superheated steam, either mainly carbonic acid and hydrogen, or principally carbonic oxide and hydrogen, or mixtures of carbonic acid, carbonic oxide, and hydrogen. In the ordinary mode of producing water gas, it is the practice to fan ignited fuel by means of blasts of air into a state of high incandescence; and steam is then passed through the hot fuel so long as the temperature remains sufficiently high to decompose it into hydrogen, carbonic acid, and carbonic oxide. After the fuel has become too much cooled down to have this effect, the steam is shut off, and the air blast is again admitted until the desired heat is once more obtained, when steam is re-admitted, and so on alternately. In the present process, however, the current of steam is superheated to such an extent that, in passing through the fuel, it will cause the ignition thereof, and will maintain it at a temperature sufficiently high to ensure the decomposition of the steam into a gaseous mixture consisting of the gases already mentioned; no air blast being used for promoting the combustion of the fuel, and there being no necessity for previous ignition of the fuel. A furnace similar to a blast furnace or lime kiln is used as the receptacle for the fuel, built of thick brickwork, and covered outside by gas-tight ironwork, as are the conduits and gas connections. The fuel, as it becomes consumed by the superheated steam, is replenished from the top through an opening, and the ashes are withdrawn from an opening (capable of being closed by a door) in the bottom of the fuel receptacle.

For superheating the steam, apparatus somewhat similar to a Whitwell regenerative and alternately working blast heating stove is used in such a manner that, whilst the steam is passing through one part of it, the other portion is being heated to the requisite temperature; and, when the one part has become cooled down to a temperature no longer high enough for properly decomposing the steam, the current is turned into the other part that has been heated up in the meantime. The direction of the current of the heating gases being changed in a corresponding manner, this current is turned into the part of the stove which has been cooled down by the steam passing through it, and so on continually. The result is that one part of the stove is always at a sufficient temperature to ensure the decomposition of the steam.

As soon as one or more of the chambers are cooled down, they are shunted out from the course of the steam, and connected with the circuit of the chambers which are being heated by the generator gases. When heated to the required temperature, they are again connected with the steam circuit; and a corresponding number of cooled chambers are simultaneously connected with the circuit of the heating gas, and so on continually. The gases and the steam to be heated travel in the same direction through the chambers; and in this manner, a number of chambers are continually heated, while an equal number are having their stored up heat abstracted by the steam passing through them.

After the heating of the chambers, they are full of the products of combustion of the producer gas. To prevent the water gas being contaminated by this, a blast of steam is sent through the chambers, to drive out the products of combustion before the re-admission of steam to be superheated. This may be done by the steam blast entering direct; but it is preferred to do so by first passing the steam through the ordinary generator, and then through the chambers—the air supply to the ordinary generator being stopped for the time, and whilst the steam jet passing through is being used for the purpose named. The patentee's object is to obtain the whole of the water gas produced for use for the purposes for which it is manufactured, and not to use any of the gas for

heating the chambers or regenerators. He therefore effects the heating of the Whitwell stoves employed for the purpose by means of less valuable ordinary producer gas, obtained in the well-known manner from any kind of fuel, either with or without the aid of steam, and does not use any part of the water gas produced for heating any of the apparatus connected with its manufacture. He thus claims to obtain nearly double the quantity of the more valuable water gas than is usual in the ordinary mode of working.

The gases which are produced by the action of the superheated steam upon the fuel are either: (1) Principally carbonic acid and hydrogen; or (2) principally carbonic oxide and hydrogen; or (3) a mixture of carbonic acid, and carbonic oxide, and hydrogen. These are all accompanied by the ammonia which is simultaneously formed by the action of the superheated steam upon the nitrogenous matter contained in the fuel wherewith the water gas is produced. By using steam alone and dispensing with an air blast acting upon the fuel, and by passing the steam in a continuous current through the fuel, the whole of the fuel is consumed by the steam alone, and practically the whole of the nitrogen in it is converted into ammonia available for recovery by a process described later on, instead of only part of it, as in previous processes.

To separate the carbonic acid from the hydrogen, or from mixtures of carbonic acid, carbonic oxide, and hydrogen, and to recover at the same time the ammonia above referred to, the patentee first reduces the temperature of the mixed gases. This is carried out by employing the heat inherent in the gases after they leave the generator, in two separate operations—viz., in the heating of the ammoniacal scrubber liquor, and in distilling it after it has been heated by means of this heat. The gases become cooled by these operations; and after they are thus cooled, they are passed through a series of scrubbers wherein they are brought in contact with free ammonia either in a gaseous or liquid state, whereby the carbonic acid becomes absorbed, whilst a solution of carbonate or sesqui-carbonate of ammonia is formed. The residual hydrogen or carbonic oxide and hydrogen gas is conveyed into a gasholder; and the solution of carbonate of ammonia formed in the scrubbers is heated by the hot gases. The greater part of the carbonic acid is thereby driven out and collected in a holder for use; and the free ammonia left behind in the liquid is distilled off by means of the hot gases, and is returned to the scrubbers to there take up more carbonic acid from a fresh quantity of gases—a certain stock of ammonia being kept for that purpose in constant circulation throughout all the apparatus, as in the now well-known Claus arrangement for gas purification.

After giving a very elaborate description of the process, of which the above is a mere outline, the patentee proceeds to describe how he proposes to separate the carbonic oxide and hydrogen and to obtain them separately. He says: When water gas is produced which contains carbonic acid, or when it has intentionally been produced with a large percentage of it, which has been removed by the process already described, and the ammonia, which may have been associated with it in one way or another, has been removed and recovered from it, the two residual gases, carbonic oxide and hydrogen, have by that operation been cooled down. They are then heated up again to a temperature somewhat above that at which hydrogen will reduce oxide of iron—say, to about 400° to 500°—but below that at which carbonic oxide will do so. This heating of the gaseous mixture may either be accomplished by means of a heating stove, such as that described for the superheating of the steam, or (as the temperature required is a comparatively low one) in stoves such as those used in connection with blast furnaces, consisting of a number of inverted U-shaped pipes. When the gaseous mixture has been heated up to the temperature above mentioned, it is passed into one of a set of six, eight, or more chambers filled with porous (yet firm) pieces of oxide of iron, and which are worked in rotation. After passing through the first kiln, the mixture flows into the second, and so on through the whole series. The hydrogen is by this operation separated from the carbonic oxide, by forming water with the oxygen of the oxide of iron and spongy metallic iron. The water formed is condensed; and the carbonic oxide is conveyed to a holder for use. The oxide of iron kilns are closed ones—connected, however, by means of iron tubes thickly lined by bad conductors of heat. They communicate with one another by pipes so arranged that any one or more of the kilns may be shunted out of connection with the others by means of valves. They are further so arranged that the gaseous mixture may be turned into any one of them, and, by similar means, the exit gases may be taken out of any one of them. The heated gaseous mixture enters one kiln of the series; and the part of the mixture which passes through the kiln enters the next kiln, and so on—the gas from the last kiln passing into a holder. As soon as the oxide of iron in the kiln into which the gaseous mixture first entered has become converted into metallic iron, the gaseous mixture is turned off from this kiln, and into the next kiln, which thus becomes the first in the series; and so on continually. The effect of this is that each kiln in its turn becomes first, intermediate, or last in the series. The kiln which contains the oxide of iron converted into metallic iron sponge, when shunted out from connection with the other kilns, is then connected with the hydrogen holder, and steam (superheated as described) is passed into it; and the hydrogen thus formed is conveyed into the holder. The superheated steam is, however, with more advantage passed successively through several of the kilns containing the metallic sponge; entering the one connected with the heated gases first, and leaving that connected last with the heated gases. When the metallic iron sponge contained in the kilns has, by the action of the superheated steam, been converted into oxide of iron, the first of the kilns is disconnected from the hydrogen holder, and again connected with the set of oxide of iron kilns, through which the gaseous mixture is passing; and this kiln then becomes the last in the series—a *modus operandi* the advantages of which will be understood without further description.

The Massachusetts Board of Gas and Electric Light Commissioners on the Subject of Water Gas.

[From advance sheets of the Fifth Annual Report from the Board, and reprinted with the consent of the Commissioners.]

The Board since its last report has continued its investigations on the subject of water gas. It is understood that the parties in interest do not desire to offer further evidence in the cases pending at the close of the year. The Board believes that some modification of the present law is desirable, and that a report of the work of the Commissioners in this branch of their duties ought to be made to the Legislature at the present time.

In the course of its inquiries the Board has endeavored to ascertain what commercial advantages, if any, might accrue to the companies from an extension of the present statutory limit of carbonic oxide, believing that in any such advantages the consumers would ultimately share, and that the companies ought to be permitted to avail themselves of them, if they could do so without prejudice to the public interest. For this purpose information has been obtained by personal inspection and correspondence from more than a hundred companies. The Board desires to gratefully recognize the uniform courtesy which has been freely extended it by the engineers in charge of water gas works in other States, and to acknowledge its obligations for the information so freely furnished.

It is clear that the cost of gas, whether coal or water, is not an inflexible figure, the same for all times and places; an advance of 50 cents per ton in coal or of one cent per gallon in oil, making an increase of 10 per cent. in the cost of coal and water gas respectively. In certain large works where both kinds of gas have been made, the advantage in cost of production has been sometimes with one, sometimes with the other kind of gas. There are more exclusively water gas works in the anthracite coal region in Pennsylvania, and within easy reach of it, than in any other portion of the country of the same area; because there the price of anthracite coal has been low, and that of gas coal relatively very high. The particular location of a gas works and its arrangement, the quality of the materials and kind of apparatus used, and the kind of labor and superintendence available, may make even larger variations in the cost of either gas.

The expenses of distribution, management, taxes, etc., are not likely to vary greatly, whether coal or water gas is the product; so that the fact of value in estimating the cost of the two gases is the cost to manufacture or cost in the holder, as distinguished from cost at the meter.

The principal items of cost in the holder are for materials, coal and oil, labor and repairs. From the cost of materials in coal gas is to be deducted the very considerable receipts from the sale of coke, tar and ammoniacal liquor. Under the best conditions in this State these receipts have reached 50 per cent. of the cost of coal, and in some companies more favorably situated they have reached a much higher percentage.

A ton of good gas coal will yield approximately 10,000 to 11,000 feet of gas. In order to secure the candle power usually supplied in this State there must be added about 10 per cent. of cannel, or something more than 5 gallons of oil, equivalent to more than one-half gallon per 1,000 feet.

In the production of illuminating water gas there is commonly used more than 50 pounds of hard anthracite coal, and from 5 to 6½ gallons of oil for every thousand feet of gas, although in the very best works

and under very favorable conditions these quantities may be slightly reduced. These two items nearly make up the cost of water gas in the holder.

In coal gas the cost of labor is a most important element. It often nearly equals one-half the gross cost of materials, and in many companies does not vary much from the net cost of coal. In water gas the cost of labor is small.

It has been very difficult for the Board to obtain definite and reliable information as to the cost of repairs in water gas works. It is not a very considerable item in coal gas, and is probably about one-half as much in water gas.

The following figures show the range of cost in certain companies, each item being calculated independently of the other, and, it is believed, fairly indicate the difference of cost in the holder of the two gases:

MATERIALS.

Coal Gas.	
Gas coal	40 to 43 cents.
Oil or cannel	3 to 7 cents.
Residuals	13 to 23 cents.
Net, for materials	20 to 30 cents.
Labor	14 to 20 cents.
Repairs	5 to 8 cents.
Total	50 to 57 cents.
Water Gas.	
Coal	11 to 15 cents.
Crude oil	13 to 18 cents.
Naphtha	24 to 33 cents.
Materials	26 to 33 cents.* / 38 to 45 cents.†
Labor	5 to 11 cents.
Repairs	2 to 3 cents.
Total	46 to 55 cents.

The figures relating to coal gas are taken from the returns of certain companies in this State, as made to the Board. The figures relating to water gas are estimates based upon information procured without the State, and intended to show what the same companies might do at current rates for materials, if they were making this instead of coal gas. It may be noted that the companies now making water gas in this State have not yet been able to equal the figures given. The relations shown above may be greatly changed at any time. The figures given for naphtha and crude oil are suggestive. A few years ago, when the number of water gas works was small, the price of naphtha was about the same as that of crude oil to-day. As the demand for naphtha for gas making purposes increased, the price advanced to a point which nearly neutralized the advantages of its use. Recently a crude oil, from the Ohio fields, difficult to refine, has come upon the market at a low price, and an apparatus specially adapted for it has again reduced the cost of water gas to the low point reached when naphtha was first introduced. There are now signs of an advance in its price.

There have been great improvements in water gas apparatus, and there is much activity in this direction now. It is now claimed that cheap bituminous coal and slack can be made to do the work of expensive anthracite; and, if the expectations of the inventors of this new process are realized, the cost of producing water gas may be greatly lessened.

In companies whose output is below a certain limit, the peculiar condition under which they make gas causes the cost to vary greatly from the figures given above. In these the cost per 1,000 feet for both coal and labor rises rapidly where coal gas is made. There is little or nothing obtainable from residuals, as all or nearly all the coke is used to carbonize the coal, and the production of gas per man is much reduced, since of necessity the gas maker must be idle much of the time. In a properly constructed water gas works of very small output, while the cost of coal may be easily doubled by the necessity for frequently cooling and reheating the apparatus, the cost of labor is not materially different from the same item in large works. In a single day one man may make and store water gas sufficient for several days' consumption, during which the works need no attention, and the gas maker can devote himself to the numerous other details of the business. Instances have been observed by the Board, in other States, where small works have been carried on in this manner with apparently good results. For reasons not easy to enumerate, the attempts by small companies in this State to pursue a similar course have not heretofore been entirely successful.

Although in the larger works, except in favored localities, the commercial advantages of manufacturing exclusively coal or water gas may not be considerable, with the methods and apparatus now most in use, the advantage to company and consumer in the combination of the two gases is now generally recognized by the larger companies, and nearly one-third of all the companies in the country manufacture some water gas. The development of electric light, combined with other causes, has greatly increased the public demand for light; a gas of 15 or 16 candles is no longer acceptable, and from 18 to 20-candle gas is as low as companies in the larger towns and cities think it wise to distribute. Gas of this quality cannot be produced with ordinary coal alone, but requires the addition of cannel coal or of oil; which latter, from its low cost and the facilities for handling, has been most generally adopted. For this use of oil the ordinary appliances of a coal gas works are but poorly adapted. When oil is used in them, it has shown a decided tendency to pass with the coal gas as a vapor, much of which is subsequently deposited in the mains or fixtures in a liquid form, or, by causing a hard substance to form at the tip, obstructs the flow of gas, and causes the forked and irregular flame so common where such gas is used; and the gas often manifests an uncontrollable tendency to smoke. To a high candle power secured in this way is often due the blackened spots in the ceilings of dwelling houses where such gas is used.

A water gas apparatus affords the means for avoiding these difficulties. In this the heats best adapted to breaking up the oily particles into a fixed gas may readily be attained, and gas of a very high candle-power be made. When coal gas is made at the same works, and the two are mixed in the proper proportions and best manner, the unfortunate results mentioned as due to oil should not occur. The gas is composed of the same constituents, but in different proportions, and reaches the burner with that combination of heating and illuminating elements calculated to produce a clear, white flame, free from smoke.

Numerous other reasons suggested by local conditions have induced companies to add to coal gas works apparatus for making water gas. It enables a company to easily meet a sudden demand for an unusual amount of gas. It can be made ready for gas making at an hour's notice, then allowed to cool when the demand is over, and this course repeated indefinitely without injury, while coal gas benches once treated in this manner would probably need rebuilding. An unexpected dark day may thus be readily provided for, and the considerable changes in consumption where street lights are burned by moon schedule, but are unexpectedly called for on stormy nights. In some places the increased consumption has made necessary some increase in the capacity of the works, which has been secured with less expense for extension by the introduction of water gas apparatus, with a consequent saving in capital account. A brief period of extraordinary consumption in midwinter is sometimes provided for in this way. In many works where both kinds of gas are made, coke produced at the works is substituted for anthracite coal, furnishing a profitable use for surplus coke, and preventing a reduction of its price.

These are some of the indirect advantages resulting from a manufacture of both kinds of gas in the same works. They are quite independent of whether one gas made alone costs a little more or less than the other. To secure them requires the distribution of a gas containing somewhat more than 10 per cent. of carbonic oxide.

The question of the comparative safety of water and coal gas is a very perplexing and difficult one to solve satisfactorily. One or more members of the Board have personally examined the premises where a large number of deaths have occurred from asphyxiation by inhaling illuminating gas in Brooklyn, New York city, Baltimore and other cities. A few of these deaths were caused by coal gas, others probably by a mixed gas; but the larger number were due to water gas. Some valuable suggestions have been obtained from these inquiries, although great difficulty was experienced in securing exact or definite information. It was impossible, for instance, in most cases to ascertain the length of time the gas was discharged into the room; and in many cases the size of the burner, and whether partially or wholly open, were only matters of conjecture. Most of the accidents investigated occurred at the cheaper boarding and lodging houses. It was found in one city—and the same facts also applied to the others in a less degree—that a very low price for gas, great activity on the part of competing companies in canvassing for customers, and the very favorable terms that were made for piping buildings and furnishing fixtures, had led to the introduction of gas into the very cheapest lodging and boarding houses that are frequented by the dissolute and ignorant classes. In several instances it was evident that the inhaling of gas alone would not have produced death, but caused it by aggravating diseases existing at the time of the accident. Some of the rooms contained less than 500 cubic feet of space, and the average space of all the rooms was about 1,100 cubic feet. The largest

* Crude oil. † Naphtha.

amount of gas was 75 cubic feet, as nearly as could be ascertained, in a room containing 748 cubic feet of space; but there was an open transom at the time of the accident, and the person lived 12 hours after being discovered. The smallest amount of gas was 18 cubic feet, in a room containing 806 cubic feet of space; and the person was dead when found. The average amount of gas in the rooms was about 38 cubic feet. But, as before intimated, the information in regard to the amount of gas in the rooms where deaths occurred is unsatisfactory. In three instances, where a man and a woman occupied rooms together, the men died and the women recovered.

In addition to these investigations the Board has obtained, from newspapers and other sources, information in regard to the deaths of 107 persons in this country from inhaling illuminating gas during the year 1889. This is probably not the whole number of deaths from this cause, but perhaps complete enough to give some facts of interest in considering the question of danger from illuminating gas. There is conclusive evidence that 30 of these persons committed suicide, and there were circumstances attending the deaths of several others that indicated more or less strongly the same cause. But, deducting from the whole number only those suicides about which there can be no doubt, there were 77 deaths caused by accidentally inhaling illuminating gas. These occurred in the following towns and cities, viz.: Yonkers, N. Y., 1; Baltimore, Md., 7; Oakland, Cal., 3; Jersey City, 2; New Brunswick, N. J., 1; Amesbury, Mass., 1; Paterson, N. J., 6; Huntington, Pa., 1; and Bethlehem, Pa., 3. In these places only water gas is believed to be manufactured. In New York city there were 24 deaths; Philadelphia, 2; San Francisco, 7; Chicago, 5; Brooklyn, 3; Washington, D. C., 2; Minneapolis, 1; Charlestown, Mass., 1. In these towns and cities a mixed coal and water gas is made, or there are coal and water gas plants in operation. There was 1 death in Cincinnati; 2 in Milwaukee; 1 in Lincoln, Neb.; 1 in Belleville, Ill.; and 1 in Portland, Me. These have only coal gas plants. The following are the number of deaths for each month, viz.: January, 9; February, 5; March, 6; April, 3; May, 5; June, 7; July, 1; August, 1; September, 5; October, 10; November, 11; December, 12.

Forty-six of the deaths occurred in hotels—generally of the cheaper class—lodging and boarding houses, where the rooms were usually small and poorly ventilated. In 18 of the accidents the gas was blown out by ignorant persons, and in 46 instances it was found turned on without any satisfactory evidence as to the cause. In 8 instances death was caused by gas stoves, in 1 by a leaking pipe, and in 3 by defective keys where the gas is turned on at the burner. Twenty-five of the persons killed were females, and 52 were males. Of the males, 17 were business men, 4 farmers, 2 professional men, 6 laborers, 2 sailors, 2 mechanics, 1 janitor, 1 railroad man, 1 teamster, 1 bartender, 1 waiter, 1 student, and 7 unclassified. Ten of the females were servants. In 20 cases the persons were more or less intoxicated at the time of their deaths.

It will be seen that 26 of the deaths occurred in places where only water gas was manufactured, 6 in those having only coal gas plants, and 46 in towns and cities where is furnished a mixed water and coal gas, or where there are plants of each gas. The largest number of deaths was 24, in New York city. In New England, where 14 cities and towns are furnished with water gas and 6 with a mixed water and coal gas, there were 3 deaths. One of these resulted from inhaling water gas, 1 from coal gas, and the third one was caused by a mixed water and coal gas.

Some of the inferences to be drawn from the above facts are that about 30 per cent. of the deaths from illuminating gas are suicides; that about 20 per cent. are persons more or less intoxicated at the time of the accidents, and a considerable number are persons unacquainted with the use of gas. A comparatively small nnmber of cases are purely accidents that could not have been avoided.

From the fullest consideration which the Commissioners have been able to give to the Act, chapter 428, Acts of 1888, they believe that the correct interpretation of the statute does not permit them to issue a revocable license or one subject to modification, to impose any terms or conditions in the exercise of it, or to qualify in any manner the certificate which the license must contain, "that in their opinion the gas can be used with safety" for illuminating purposes. The degree of danger in the use of coal gas, water gas, or a mixture of the two, depends largely on the amount of carbonic oxide it contains. It is probably true that the Legislature of 1880 fixed the limit of carbonic oxide at 10 per cent. because that limit was not exceeded in the manufacture of coal gas, and not because it was safe. Many reliable gas engineers now believe, and have expressed the opinion to the members of the Board, that commercial necessities exist at the present time for permitting a larger percentage. The danger which appertains to the careless use of all the gases named is an obstacle, in the minds of the Commissioners, against granting a license in the form contemplated by the statute. Coal gas is used for illuminating purposes, not by reason of its elements of safety, but because of its ease of distribution, convenience, neatness, economy, and the excellence of its light. Its dangers are widely known. Water gas or a mixed gas is somewhat more dangerous; but should its use be wholly prohibited, if the present state of the art shows that in some communities a better and cheaper light can thereby be supplied, and the increased risk can by care be overcome?

In many cities and towns a mixed gas is served, containing from 10 to 20 per cent. of carbonic oxide; in others, water gas having from 25 to 30 per cent. of the same constituent. In these places, as a rule, the question of safety or danger does not enter into the calculation; the managers of the gas companies there simply consider the economy and quality of the light, and the same is true of the consumers. As the accidents are chiefly caused by ignorance or carelessness, the general public feels no alarm, as people do not ordinarily charge themselves with being either careless or ignorant. But all intelligent persons agree that too much caution cannot be exercised. When used by watchful, careful consumers, almost any gas can be called safe; but in the hands of the careless or ignorant, the same gas will be dangerous. The more poisonous gas can perhaps be made practically safe by keeping the gas pipes and fixtures tight, by the use of smaller burners, or by providing ample means of ventilation if the gas by any means should escape.

If a thing in itself be dangerous, the knowledge of its character and a warning in its use are likely to prevent harm. How can a certificate of safety be attached, without misleading the very ones whom it is desired to make more careful? Although a mixed gas or water gas is somewhat more rapid in its poisonous effects, if inhaled, than common coal gas, is it not quite probable that a little more care on the part of those who distribute and use the gas may fully offset the increased element of danger it contains? The mere knowledge that it is more harmful would naturally lead people to be more careful. Some of the accidents are caused by defective fixtures or burners; these could be inspected and kept in repair. A company might be required to examine them periodically. If the proportion of carbonic oxide be extended, especially to the degree found in water gas, the size and number of burners in sleeping apartments might be limited, and means of ventilation insisted upon. The attention which has of late been called to deaths by the inhalation of gas has led inventors, with more or less success, towards the discovery of some automatic device for closing the pipe or burner, in case the light is blown out or by some accident the gas is turned on. Something of the kind might be desirable, especially in lodging rooms. These suggestions are made simply by way of illustration. Other and more effective provisions might be adopted. The Board is firmly of the opinion that the certificate as to safety ought to be omitted from the license. Such a certificate, it is confidently believed, will in no way serve to protect consumers. The Board respectfully suggests that it should have power to place such conditions in the license as in its judgment will tend to guard the community against accidents. The license should also be made revocable, or be subject to modification, as the most practical means of enforcing its provisions and speedily preventing any further danger which might be likely to arise.

For these reasons a change of the statute is urged upon the attention of the Legislature. The draft of a bill * embodying the views of the Commissioners, is submitted, and the passage of some such act is respectfully and strongly recommended.

AT the stockholders' meeting of the Waltham (Mass.) Gas Light Company the following result was reached: Clerk and Treasurer, Geo. A. Stearns; Directors, Lowell Clark, John R. Farnum, Arthur T. Lyman, A. M. Goodale, Geo. A. Stearns, Wm. Roberts, and Augustus Flagg. The last two named take the places of M. H. Young and C. E. Getchell, resigned. The annual report of the Treasurer shows that the balance on hand, Jan. 1, 1889, was $41,639.25, and the income for the year $27,631.59, making a total of $69,270.84. Out of this dividends to the amount of $8,400 were paid, interest took $1,022, insurance, $388, and construction $4,142, leaving a surplus on Jan. 1, 1890, of $55,308.84. The income in 1888 was $28,419.26, or $787.67 more than in 1889. The Company now has 42 arc electric lights in use for the city, and 50 for commercial purposes, besides 61 incandescent 65-candle power lamps, and 565 of 40-candle power.

* For a copy of bill, see JOURNAL, *ante*, p. 206.

[Official Report.—Revised by the Secretary.]

TWENTIETH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held at Young's Hotel, Boston, Mass., Feb. 19 and 20, 1890.

First Day—Feb. 19—Morning Session.

The Twentieth Annual Meeting of the New England Association of Gas Engineers was held at Young's Hotel, Boston, Feb. 19 and 20, 1890, the President, Robert B. Taber, of New Bedford, Mass., in the chair.

The first session was called to order Wednesday, Feb. 19, at 10 A.M. The President announced that the Secretary, Mr. C. H. Nettleton, was necessarily absent, and, on motion of Mr. Stiness, Mr. C. J. Russell Humphreys was appointed Secretary *pro tem.*

Committee on Invitations.

The President—I will appoint Mr. Slater and Mr. Norton to serve as a committee to invite gentlemen who have done us the honor of being present, and who may be eligible to be with us, to join us; and also to invite anyone whom they may know to be in the city, and whose attendance might interest or benefit the Association, to meet with us.

Mr. Slater—I presume that "eligible to meet with us" means any gas man?

The President—I purposely put it in that way. Your own sense of their eligibility will determine whom you shall invite to join with us in our deliberations.

Disposing of the Minutes.

The President—The first business in order will be the reading of the minutes of the last meeting.

Mr. Harbison—I move, as the minutes have been printed in the American Gas Light Journal, that they stand approved as printed.

Mr. Stiness—I second that motion.

The motion was passed.

Applications for and Election to Membership.

The President—The next regular business will be the consideration of applications for membership. The Secretary has a list of those whose names have been scrutinized by the Board of Directors and approved by them.

The Secretary read the following list of applicants for membership, as approved by the Board of Directors:

Active Members.

A. C. Anthony, Providence, R. I.	E. J. Nutter, Milford, Mass.
Henry Boardman, Bangor, Me.	J. J. Nutter, Milford, Mass.
Andrew J. Horton, Brattleboro, Vt.	G. M. Rossman, Keene, N. H.
F. H. Lane, Wallingford, Conn.	L. A. Saville, Lexington, Mass.
H. M. Lane, Leominster, Mass.	Wm. H. Spaulding, Clinton, Mass.
F. W. Norton, Nashua, N. H.	

Associate Members.

Frank H. Brown, Waltham, Mass.	Wm. E. McKay, Boston, Mass.
Geo. C. Hicks, Boston, Mass.	Chas. E. Willard, Boston, Mass.
William Homes, Boston, Mass.	E. H. Woodward, Concord, N. H.

On motion of Mr. Harbison, Mr. Stiness was directed to cast the ballot of the Association for the election of the applicants named; and they were declared to be duly elected to membership. The new members were then introduced to the Association.

Resignation of Mr. Jas. Porter.

The Secretary having read a letter from Mr. James Porter, resigning membership in the Association, the President remarked that the Directors acted upon it last night, and approved it; but he thought it proper that it should be brought before the whole body.

Letters of Regret.

The President—We have several letters received from members of our own body, and from others who have been invited to attend this meeting, regretting their inability to attend. The Secretary will read the names, but I think we will not delay business by reading the letters.

The Secretary stated that letters of regret had been received from—

H. C. Adams,	T. J. Hayward,
Walton Clark,	Prof. E. G. Love,
C. A. Coffin,	John McIlhenny,
W. H. Denniston,	George S. Page,
Frederic Egner,	Geo. G. Ramsdell,
D. D. Flemming,	W. Cary Sanger,
G. A. Hyde, Jr.,	Robt. Young.

Mr. Stiness—I would like to ask if, in the reading of papers, we are to follow the printed programme. I suppose there are some members here who feel more interest in some of the papers than they do in others; and as our country members do not get to Boston every day, I have no doubt they would be glad to know when certain papers are to be read, in order that they may be present to hear them.

The President—The announcement merely states that "during the meeting the following papers will be read." It was understood that Mr. Nettleton would give us some idea how he had arranged this matter; and in his absence the Directors at their meeting last evening thought they would select such times for reading the papers as the writers of the papers might prefer. For that reason I cannot now state the order in which the papers will be read; but if anyone having a desire to hear a certain paper will express it, and the writer can be found, the paper may be read at any time. There are certain of the papers which would naturally group themselves, and which should properly be read together, but no definite arrangement of that kind has been made. The Secretary will listen to suggestions from any member as to the order of reading, and I have no doubt the meeting will be glad to follow any desired order. The reading of Mr. Addick's paper has been deferred until to-morrow, as he is not prepared to read it to-day.

ROLL CALL.

Upon the call of the roll the following members answered to their names as being present:

Honorary Members.

Jos. R. Thomas, New York City. Col. Fred. S. Benson, Brooklyn, N.Y.
Eugene Vanderpool, Newark, N. J.

Active Members.

Addicks, W. R., Boston, Mass.	Learned, Waldo A., Newton, Mass.
Africa, W. G., Manchester, N. H.	Long, Robt. J., Salem, Mass.
Allyn, H. A., E. Cambridge, Mass.	Macmun, Geo. F., Natick, Mass.
Amory, Dr. R., Brookline, Mass.	Manchester, Geo. L., Easthampton, Mass.
Anderson, Wm., Marlboro, Mass.	
Andrew, John, Chelsea, Mass.	Manchester, J. Howard, Bristol, R.I.
Atwood, H. A., Plymouth, Mass.	Moore, David, Salem, Mass.
Badger, Wm., Concord, N. H.	Neal, G. B., Charlestown, Mass.
Bill, Geo. D., Malden, Mass.	Norton, H. A., Boston, Mass.
Blood, F. C., Ware, Mass.	Parker, Albert H., Bangor, Me.
Boynton, D., Chicopee, Mass.	Prichard, Chas. F., Lynn, Mass.
Burnham, J. H., E. Boston, Mass.	Quinn, Andrew K., Newport, R. I.
Cabot, J., New York City.	Richardson, F. S., N. Adams, Mass.
Coffin, J. A., Gloucester, Mass.	Sherman, F. C., New Haven, Conn.
Coggshall, H. F., Fitchburg, Mass.	Slater, A. B., Providence, R. I.
Cooper, A. F., Exeter, N. H.	Slater, A. B., Jr., Providence, R. I.
Copp, A. M., Boston, Mass.	Snow, Wm. H., Holyoke, Mass.
Coyle, P., Charlestown, Mass.	Spaulding, C. F., Waltham, Mass.
Davis, F. R., Athol, Mass.	Spaulding, C. S., Brookline, Mass.
Fowler, S. J., Westfield, Mass.	Spear, J. Z. A., Dorchester, Mass.
Gerould, C. L., Brooklyn, N. Y.	Stedman, W. A., Rochester, N. Y.
Gillmor, O., Norwich, Conn.	Stiness, S. G., Pawtucket, R. I.
Goodno, G. F., Dedham, Mass.	Taber, R. B., New Bedford, Mass.
Greenough, M. S., Boston, Mass.	Tarbell, A. Willis, Waltham, Mass.
Harbison, J. P., Hartford, Conn.	Tarbell, Wm., Waltham, Mass.
Hassett, E. J., Beverly, Mass.	Tilton, D. D., Newburyport, Mass.
Humphreys, C.J.R., Lawr'nce, Mass.	Todd, J. R., Middletown, N. Y.
Jenks, Z. M., Woonsocket, R. I.	Wells, Levi W., Boston, Mass.
Jewitt, M., Clinton, Mass.	Wetherbee, G. E., Worcester, Mass.
Jones, E. C., Boston, Mass.	Wood, Gideon, New Bedford, Mass.
Kelly, H. H., Greenfield, Mass.	Wood, W. A., Dorchester, Mass.
Lamson, C. D., Worcester, Mass.	Woodward, R., Waltham, Mass.
Leach, H. B., Taunton, Mass.	Yorke, E. H., Brockton, Mass.
Learned, E. C., N. Britain, Conn.	

Associate Members.

Coburn, Cyrus M., Chelsea, Mass.	Smith, Robt. R., N. Hartford, Conn.
Davis, Fred. J., Waltham, Mass.	Tufts, Nathaniel, Boston, Mass.
Gifford, N. W., N. Bedford, Mass.	Tobey, F. Jr., New Bedford, Mass.
Holmes, R. E., W. Winsted, Conn.	Waldo, Chas. S., Boston, Mass.

The Committee on Invitations announced that the following non-members would attend the sessions at the invitation of the Association:

Barker, F. E.	Daley, D. R.	Graeff, Jr., G.W.	Rowland, C. L.
Bush, J. S.	Dickey, C. H.	Howard, Gov. J. L.	Shelton, F. H.
Blodget, C. W.	Fowler, Jno.	Kreischer, G. F.	Sprague, F. R.
Corbett, C. H.	Fry, C. C.	Loomis, B.	Stanley, I. N.
Coggeshall, C.H.	Floyd, F. W.	McDonald, W.	Wood, A. C.
Coffin, A. B.	Goodwin, W.W.	Mooney, Wm.	White, Wm. H.
Down, W. H.	Gardner, Jr., J.	McGeorge, D.H.	Weber, O. B.

(To be continued.)

The Proposed Hatteras Light.

The proverbial dangers of Cape Hatteras, says the *Engineering Record*, are due not only to its exposed position on a much-traveled line of coastwise trade, but to the fact that very dangerous shoals extend from it several miles seaward, on which vessels might strike in bad weather before seeing the light on the Cape itself. Several whistling buoys placed on the shoal had been carried away, owing, as is supposed, to the links of their mooring chains having chafed through by incessant motion in the grinding sand, and with increasing commerce the loss and danger became so great that in January, 1883, many underwriters, merchants, owners and sea captains petitioned Congress for a lightship to be stationed at that point, which, in view of the fate of the buoys, the Light House Board did not consider wise, as if the lightship should get adrift on a lee shore her loss with all on board would be inevitable.

A lighted beacon, consisting of a skeleton iron tower, 40 or 50 feet high, with a reservoir for compressed gas, had already been suggested, and Major O. E. Babcock, U.S.A., Engineer of the Fifth Light-house District, was ordered to examine and report as to the feasibility of such a scheme. He, in July, 1883, reported the project feasible, though likely to be dangerous and expensive in execution; as, however, the preliminary work would be as expensive for a beacon as for a light-house, he advised the construction of the latter on an iron pier, built after the manner of those at Long Branch and Coney Island, the light-house itself to be of the same character and 80 to 100 feet high.

Nothing more seems to have been done for nearly two years, when, in June, 1885, plans and estimates for the proposed structure were obtained from Sooysmith & Co., engineers and contractors, of New York city. They advised the use of an octagonal wooden caisson for the foundation, and estimated the cost of the entire structure at $500,000. In January, 1888, Congress appropriated that sum for the construction of the light-house with the important provision "that such contractors for doing this work may be selected by the Light-house Board, as may, in the judgment of the Board, be best fitted by reason of skill, experience, possession of plant and control of means to do the work." Bids have accordingly been invited for the complete construction, equipment and temporary maintenance of the proposed light-house, and will be received up to July 1, 1890.

The following extracts are taken from the specifications:

The locality is one of the most exposed on the coast. The site has about 24 feet of water over it at low tide; the rise and fall of the tides at the site is about 1½ feet; the current velocity has been estimated at 4 knots per hour after heavy gales, and the surface of the shoal at and in the vicinity of the site is composed of fine gray sand with broken shells.

The tower is to be an inclosed structure, 150 feet high from low water mark to the focal plane of the lantern.

The foundation of the tower must be solid and massive to withstand the impact of the waves. Its base must be sunk to a stratum underlying the surface of the shoal which offers sufficient resistance to the weight of the structure; and should this stratum consist of material which can be scoured or displaced by the sea, it must be deep enough below the latter to be out of all possible reach of the destructive action of the water.

The site all around the structure is to be protected by a riprap packing, composed of granite blocks, weighing not less than 2 tons apiece. The slope line of the packing must intersect the foundation at low water mark and the original surface of the site at a distance of 40 feet from the structure.

The first floor of the structure is to be at least 30 feet above high water mark. The choice of the various kinds of material to be used in the construction of the tower is to be left to the designer and the contractor.

The probable construction will be that of an immense wooden caisson with a tapering iron tube projecting upwards from its center. This will be built at some convenient port and towed out to its site, being lifted on the way over a bar where there is but 8 feet of water at high tide. When the site is reached it will be rapidly sunk until the cutting edges enter the sand, when the water will be forced out by compressed air and the bottom excavated from within until the desired depth is reached, when the entire caisson and the tube up to 30 feet above high water will be filled solid full of concrete. Above this will rise an iron or steel tower having 10 stories, including the watch room and lantern.

The contractor must fix the time at which he will have the work completed, and must commence work within one month after the contract has been awarded. When the light-house is finished he must completely equip it and keep it in satisfactory operation for one year before any of the work is to be paid for.

The Hatteras Light, when completed, will be one of the most important and difficult pieces of light-house work ever executed, the only structures comparable to it being the Rothersand Light-house on the coast of Holland and that on Fourteen Foot Bank in Delaware Bay.

Preventing the Incrustation of Boilers.

Walter Chambers, in an article on this subject, says that although much has already been written upon the management and care of steam boilers, and many expedients proposed for removal of incrustation, more might advantageously be said about the benefits to be gained by a wider recognition of those means for promoting economy by preventing incrustation and its attendant waste of fuel. It is estimated that 1-16 inch of scale causes a loss of 13 per cent. of fuel; ⅛ inch, 38 per cent., and ¼ inch as much as 60 per cent., besides predisposing the boiler to explosion as well as incurring the loss of time and labor for its removal.

Many of the misnamed and anti incrustators contribute to the evil, as they contain organic matter, and help rather than hinder incrustation, while those that are effective in water containing carbonates of lime frequently liberate pyroligneous acid that adversely affects the iron; then the alkaloids, when used in excess, conduce to foaming, and, in conjunction with the oil from the engines, they saponify or form soap.

The presence of damp air is prejudicial to the interior of a boiler, as the process of oxidation or corrosion is thereby accelerated; when we reflect that the feed pump is commonly made about twice the capacity required for the feed water, it is obvious that a considerable amount of air, and consequent deterioration of the boiler, is thus accounted for. A remedy is easily found in a self-adjusting pump, the duty of which could be controlled by means of a float, so that it would deliver the requisite amount of solid feed water without air. A thorough system of economy and efficiency would comprise a surface condenser for returning the pure water obtained from condensation of the exhaust steam from the engine, together with a small evaporator heated by the waste chimney gases, for making up any loss of pure water due to leakage of steam. These are simple and now well recognized contrivances, and a comparatively small outlay in this direction would prevent the many evils due to incrustation and should lessen the premium of insurance and effect a saving in expenditure.

Boilers are subject to the chance of damage when safety valves or pressure gauges are out of order. Not a day should pass without ascertaining that the former are in operation, while the index of the gauge should, if correct, stand at zero when the steam is off, and also show the same pressure as the safety when it blows off, so its accuracy is readily ascertained.

The level of water in the boiler should be verified at regular intervals by means of the gauge cocks fitted for that purpose, quite independently of the gauge glass; all these require frequent blowing to ensure safety, since we learn that the majority of serious explosions are due to shortness of water. The benefits of using hot feed water have already been referred to, and in no case should cold water be pumped into a hot boiler, as local contractions, leaky seams and joints, and even ruptures may be occasioned, while for similar reasons cold air currents should also, as far as possible, be excluded from the furnaces and flues.

Boilers also suffer, to a considerable extent, from the lubricants from the engine that find their way in with the feed water. Many of them are deleterious to a degree, and have doubtless contributed to many adverse occurrences. Perhaps there is no detail deserving of more attention than that of selecting suitable lubricants. Their influence upon the economy of the boiler will be more apparent when referring to efficient lubrication in its relation to the durability of machinery.

The Connellsville Coke Trade.

A local authority writes that the coke trade of the Connellsville region for 1889 beats the record from 15 to 20 per cent., and is altogether immense. But, big as it was, the record for 1890 will, unless all signs fail, not only equal, but surpass it. With such a comforting assurance for the future, we may contemplate the past with some degree of complaisance. During the year just ended the Connellsville coke operators marketed 326,220 cars of coke, aggregating 5,825,000 tons. A large portion of this immense output, the greatest output in the history of the greatest coal region in the world, was sold at prices near the dollar mark, yet the average price of the total output was about $1.40 per ton, at which rate the spot value of the yearly output would be about $8,150,000. The output for 1888 was in round numbers 5,000,000 tons, of the average value of $1.20, making a total value of $6,000,000. These figures show a decided increase in trade during the past year, in spite of the very dull manner in which it opened. The beginning of 1889, it will be remembered, ushered in a declining coke trade, which continued into Februa-

ry, when production and shipments were 25 per cent. below January figures. Production was therefore restricted both by allowing ovens to grow cold and by ordering lay-off days. The demand increased somewhat in June, but the Johnstown disaster retarded eastern shipments considerably. The July output rose to the January average, but the August strike cut it down again to the February figures. Since then it has been hovering between 500,000 and 600,000 tons per month.

The following is a statement of the estimated tonnage for 1889, condensed from the weekly reports collected by the *Courier:*

January	524,447
February	417,280
March	433,090
April	418,534
May	454,250
June	421,178
July	497,115
August	415,254
September	513,190
October	600,624
November	537,645
December	593,219
Total	5,825,826

The shipments for 1889 show a grand total of 326,220 cars, an average of 1,046 cars per day for every working day in the year. Following is a comparative statement from the *Courier* files, showing the shipments during 1888 and 1889, with the daily averages appended:

1888.	Pitts.	West.	East.	Total.	Av.
January	4,125	13,600	2,500	20,225	778
February	3,500	10,500	4,500	18,500	740
March	2,625	12,000	4,000	18,625	680
April	2,000	12,600	5,600	20,200	808
May	4,300	13,800	6,700	24,800	919
June	4,900	9,460	4,800	19,160	766
July	4,000	10,700	5,860	20,560	790
August	5,350	12,450	6,650	24,450	905
September	5,270	13,916	6,140	25,326	1,013
October	5,900	17,900	5,925	29,725	1,100
November	6,325	17,685	6,060	30,070	1,156
December	6,800	17,900	6,100	30,800	1,174
Totals	55,095	162,511	64,835	282,441	905
1889.	Pitts.	West.	East.	Total.	Av.
January	6,650	16,125	5,640	28,415	1,052
February	5,300	12,700	4,725	22,725	947
March	5,713	14,437	5,426	25,576	984
April	5,356	13,736	5,881	24,773	951
May	5,375	15,130	6,042	26,567	984
June	6,090	15,059	4,350	25,499	1,020
July	6,154	15,910	6,304	38,368	1,050
August	5,560	12,240	4,037	21,837	808
September	5,815	16,155	5,284	27,254	1,090
October	7,325	16,550	6,180	30,055	1,113
November	6,640	18,659	6,152	31,451	1,210
December	6,800	20,300	6,600	33,700	1,348
Totals	72,778	187,021	66,421	326,220	1,046

The prices for coke for 1889, like those of 1888, ran the gamut from $1 or less to $1.75 or more. The operators started out in 1888 by dropping the figure from $2, to which coke had gotten during the latter part of 1887. Within three months it was down to the dollar mark. The two concluding months of the year saw a big demand and a modest advance in price to $1.25. This figure held good for the first three months of 1889, in spite of a declining demand, but April 1 saw a slumpy market, and in a few short weeks dollar coke again ruled. During the midsummer it was hard to get 90 cents for it. In August the workingmen took the bull by the horns by demanding an advance in wages equivalent to 12 per cent. They enforced it by a successful strike and prices perforce went up from $1.35 to $1.50. A booming trade set in and sustained this rather radical advance. November and December coke sold for $1.75, with special orders as high as $1.90 to $2. A determined move was made o put the price to $2 with the beginning of the present year, but more conservative counsels prevailed.

The following table gives the prices of coke for the last six years, on board the cars at ovens, per ton of 2,000 pounds:

Month.	1884.	1885.	1886.	1887.	1888.	1889.
January	$1.00	$1.10	$1.20	$1.50	$1.75	$1.25
February	1.00	1.10	1.35	2.00	1.75	1.25
March	1.00	1.10	1.35	2.00	1.50	1.25
April	1.10	1.20	1.35	2.00	1.00	1.15
May	1.10	1.20	1.50	2.00	1.00	1.10
June	1.10	1.20	1.50	2.00	1.00	1.10
July	1.00	1.20	1.50	2.00	1.00	1.00
August	1.10	1.20	1.50	2.00	1.00	1.00
September	1.10	1.20	1.50	2.00	1.00	1.35
October	1.10	1.20	1.50	2.00	1.00	1.50
November	1.10	1.20	1.50	2.00	1.25	1.75
December	1.10	1.20	1.50	2.00	1.25	1.75

Among the notable features of the coke trade of 1889, aside from those already touched upon, two stand out in bold relief, namely, the car famine that was and the coke king that is. As soon as the fall trade began to boom and the operators knew once more what it was to have orders to their full capacity, the railroads betrayed an inability to handle all the traffic. Both cars and motive power seemed inadequate. Some of the larger operators, despairing of a remedy, bought large numbers of individual cars. These, together with the cars furnished by the railroads, last month, for the first time, were able to meet the demands made upon them.

During the year the H. C. Frick Coke Company succeeded in purchasing controlling interests in a number of ovens, buying several of their largest competitors outright. Their holdings now cover about two-thirds of the region. They made their principal purchases during the summer, when trade was dull, with prices nearer 90 cents than $1. The year has also been marked by considerable activity in the oven building line. As a consequence the total number of completed ovens in the region has increased from 13,975 to 14,458.

Profit in Gas Making.

The half-yearly report of the Directors of the London Gas Light and Coke Company, for the six months ended December 31, 1889, seems to us to show that there is good profit in selling gas cheaply. We make the following extracts from the report:

The accounts for the half-year ending the 31st of December last show that, after providing for interest and preference dividends, a balance of £574,785 remains, out of which the Directors recommend the statutory dividend on the ordinary stock of the Company at the rate of 13¾ per cent. per annum.

The half year just passed has been remarkable for a substantial increase in the quantity of gas sold, which amounts to nearly 5½ per cent. over the quantity sold in the corresponding period of 1888. This result is mainly due to the rapidly extending use of appliances for cooking and heating by gas, and, in a lesser degree, to the improvement in the lighting business brought about by natural expansion and by the undoubtedly prosperous condition of general business. The great number of cooking and heating stoves sold and fixed by the Company during the past six months, leaves no doubt in the minds of the Directors that the use of gas for fuel is being very largely developed.

In order to meet the requirements of the public for a more extensive supply of gas, it will be necessary to increase the manufacturing plant at some of the Company's stations, and also to add to the storage and distributing plant by the erection of additional gasholders. For these purposes an issue of new capital will shortly be necessary, of which due notice will be given to the proprietors.

The favorable condition of the trade of the country, while exercising a beneficial effect upon the Company's business, has, on the other hand, greatly augmented the price of materials used in construction and of coal for carbonizing. The rise in the price of iron, fire goods, and stores generally is very considerable; and this increased cost of material, coupled with the very large addition which has been made to the expenditure of the Company in wages (amounting to about £150,000 per annum), will cause a heavy addition to the charges on revenue, and tend to retard the further decrease in the price of gas. The extent to which the balance of profit may be adversely affected will, in a great measure, be governed by the increase which may be looked for in the sale of gas, together with improved prices of coke and other residuals.

With regard to the supply of coal, the contracts, at favorable prices, under which the Company is working have yet about six months to run. Proposals for the extension of some of them for further periods, with a re-arrangement of price, are under the consideration of the Directors.

The Company has, so far, been free from the labor troubles and

complications which have lately occupied so large a portion of public attention, and which resulted in the crisis in Manchester and South London. The new arrangements of eight-hour shifts, and other modification of working hours and rates of pay, which were agreed upon in the spring with the Company's workmen, have, in spite of such minor difficulties as are incident to novel conditions of manufacture, worked fairly well. The Company has strictly adhered to its engagement with the men, who, on their side, have, on the whole, responded in the same spirit. The Company has abstained from in any way interfering with the organizations of its men, and has endeavored to meet any differences which have arisen in an equitable and conciliatory spirit. The Directors placed no credence in the rumors which became current that their men would throw up their employment for the purpose of bringing pressure to bear in a dispute in which this Company was not immediately concerned; but they did not neglect precautions to meet such a state of affairs had it unfortunately come about.

During the autumn, the Company's Engineer-in-Chief visited the United States of America, with the view of investigating the methods of gas manufacture in the large cities there, more particularly in reference to the various systems of lighting by water gas. The result of his examination led him to the conclusion (in which the Directors concur) that, while enriched water gas for lighting and heating is not likely, in this country, to replace coal gas, it may be found useful to provide for the manufacture of water gas, to be used in addition to, and in conjunction with coal gas on occasions when a large quantity of gas is required to meet a sudden demand. The Directors have inaugurated some experiments for testing, in a practical manner, the feasibility of thus supplementing their manufacturing plant, as well as of other suggested methods of improving the carbonizing of coal and the dealing with residuals.

The judgment of the House of Lords, given on the 9th of August last, in the Nine Elms case, between the Gaslight and Coke Company and the South Metropolitan Gas Company, was in favor of this Company—reversing the two previous adverse judgments in the Courts below. The decision, carrying costs, was unanimous, and protected this Company on all points. A perpetual injunction was granted against the supply of gas by the defendant Company for consumption outside the limits of its own district, and damages, the amount of which is now being ascertained, were awarded to this Company. The Directors attach great importance to this judgment of the final Court, as it confirms the inviolability of the Company's district, as settled by the Act of 1860.

The question of simplifying and improving the method of the official testing of gas for illuminating power and purity has made further progress; and the Directors hope that the public authorities and the Company may be able to agree upon a basis for the legislation necessary for its settlement.

Nothing has occurred since the issue of the last report to alter the opinion of the Directors that the progress of electric lighting will not produce any injurious effect upon the business of the Company.

After a half year full of interest, and not free from anxiety, the Directors look forward with confidence to the continued prosperity of the Company, which, however, can only be secured and shared in by proprietors and employes through the cordial co-operation of all connected with the Company in making its working economical and successful in all its branches.

Tinting Incandescent Lamp Bulbs.

Mr. Arthur S. Huey, of Minneapolis, proposes the following method of treating incandescent lamp bulbs: Prepare the glass by thoroughly washing in soap and water and drying. Then dip in bath (made by beating up the whites of two eggs in one and a half pounds or pints of water, and filtering) and hang up to dry. Dissolve the aniline color in photographer's common collodion. Red or blue aniline will form clear solutions, while the green solution will require filtering. Yellow aniline forms a handsome color, but the surface of the glass presents a frosted appearance after the application. Violet and purple colors may be obtained by combining red and blue in different quantities. When the solution is ready, dip the prepared glass bulbs therein, hang up to dry, and finally pass a current through the bulb for half an hour, that the heat thus generated may harden the coating of the collodion, or place in a current of air. The preparation can easily be removed with alcohol or sulphuric ether, but is not affected by water. Experience has shown that the best results are obtained by not using too much aniline. Make the color light rather than deep, and apply two or three coats.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Some time ago we noted that the authorities of Downington, Pa., had appointed a committee to negotiate with the owners of the local gas plant, the same to be operated thereafter on municipal account, and that the owners were not averse to parting with their property. While the closing details were being arranged, some of the residents rather unaccountably raised objection, the result of which was that the proprietors of the Gas Company withdrew their offer to sell.

The town of Centralia, Wash., is to light its streets by electricity, the authorities having granted a franchise to a Company, the proprietors of which are to have an exclusive right for 25 years to distribute electric currents in Centralia. The public lighting contract calls for the maintenance of 10 arcs (2,000-candle power), to be paid for at the rate of $12 each per month, on a midnight table, the rate to be increased to $15 per month in case it is determined to run the light until 3 A.M. The rates to ordinary users (on the basis of a 16-candle power incandescent lamp) have been adjusted to the following: To run until 9.30 P.M., $1.25 per lamp per month; until midnight, $1.50; all night, $2.00.

The reduced gas rates for Steubenville, O., are to take effect on April 1st. Even at the risk of duplicating the information, we give the new schedule:

Monthly Consumption.	Net Rate per 1,000.
Under 5,000 cu. ft.	$1.50
Over 5,000 cu. ft., but under 10,000	1.35
Over 10,000 cu. ft.	1.20

This is reasonable enough, and speaks well for the Company's liberality.

From a Philadelphia source we learn that complaint is loud in some sections of the city about the defective condition of many of the gas services. Chief Engineer Park explains this by saying that the defective pipes pass through soils that are very destructive to iron.

Some time ago we noted that the Boston Electric Company had instituted suit for patent infringement against Charles W. Holtzer and the Holtzer-Cabot Electric Company. The defendants are charged with infringing letters patent No. 250,590, granted July 27, 1880, to Jacob R. Tirrell, and letters patent No. 281,345, issued July 17, 1883, to Chas. H. Crockett, both relating to improvements in electric gas lighting apparatus. The important feature in the Tirrell invention is turning the gas cock by a single electric impulse. Though the complainants' experts differ as to this, yet upon the affidavits the court holds that the defendant's contention is correct. The issue is then narrowed down to this, whether the court should enjoin the defendants against the use of a burner so constructed that the gas cock is opened by a series of electric impulses, when the claim of the Tirrell patent makes the turning of the gas cocks by a single impulse, one of the most important elements on a motion for an injunction, *pendente lite*, where the mind of the court must be satisfied on the subject of infringement, an injunction should not be granted under these circumstances. As to the Crockett patent, he court was inclined to the opinion that it must be limited to the form of the devices therein described, or what is clearly equivalent. The device for opening the gas cock, and especially the ratchet and pawl, which are found in the defendant's burner, should not be considered the equivalent of the projections at the end of the valve and the opening devices described by Crockett. The defendants' burner, therefore, does not infringe, or at least there is so much doubt of it that no injunction should issue.

As was predicted in the Journal about a fortnight ago, the plant and franchises of the Batavia (N. Y.) Gas Light Company have gone into new hands. The purchaser, however, was the local Consumers Electric Light and Power Company, whose proprietors will now consolidate the hitherto conflicting interests. The officials of the Consolidated Company have been named as follows: President, S. D. Purdy; Secretary and Treasurer, Chas. H. Caldwell. The capital stock in the enterprise is about $100,000, and a considerable sum will be expended in betterments to the gas plant.

The Committee on Manufactures, Massachusetts Legislature, has voted unanimously against the proposition that gas companies in that State should be prohibited from declaring dividends in excess of 10 per cent. per annum.

At the annual meeting of the Natick (Mass.) Gas Company the following officers were elected: President, Riley Pebbles; Secretary and Treasurer, Edward Clark; Directors, Riley Pebbles, Edward Clark, Harrison Harwood, John O. Wilson and L. Winch.

On the 6th inst. the Superintendent of the Napa (Cal.) Electric Light Company was ordered to close down the works until further notice. This abrupt decision discomfited the users of incandescent lamps, and the consumers were not greatly mollified when told that the plant was shut down "because it needed repairs." In all probability the supply of electric light currents is not a profitable business at Napa.

At the annual meeting of the Portsmouth (N. H.) Gas Light Company the following choice of officers was made: President, John Sise; Clerk and Treasurer, Frank J. Philbrick; Directors, John Sise, Marcellus Eldredge, W. W. Cotton, Edward S. Fay and H. W. W. Jackson.

Supt. Tracy, of the Poughkeepsie (N. Y.) Gas Company, says that the use of gas for fuel purposes in that city is spreading with amazing rapidity.

An important change (see advertisement of Company, page 267) has occurred in the management of the Westinghouse Machine Company's St. Louis District Agency.

Prof. Richard T. Ely, of the Johns Hopkins University, of Baltimore, Md., has again turned his attention to gas matters, having delivered (Feb. 13) the second of his two lectures on "Taxation." He spoke before a large audience in the Peabody Institute, and a summary of his speech is appended:

The results of our inquiry into taxation thus far have given us results which may be formulated under these five heads.

1. Taxes have brought us representative government, and they tend to grow with the growth of free institutions.

2. Taxes are not payments for services rendered by governments but a taking by the nation of that to which it is entitled.

3. The amount to which the nation (State or city) is entitled can only be determined by the conscience and intelligence of the community.

4. Taxation is being used, and will be used to greater extent hereafter, as an agency for social reform.

5. Other sources of income than taxation must be found in governmental pursuits.

Our situation is briefly thus: The expenditures of government have increased with enormous rapidity in recent times, and there is every reason to anticipate that they will continue to increase in the future. The man who has looked only a little way into this subject is tempted to say: If we reform government by means of good civil service and by other devices, we can introduce retrenchment into practical administration. Unfortunately for this theory—for it is pure theory—governmental expenses have increased most rapidly where administration is purest. An inevitable effect of better government in Baltimore or Maryland would be to increase, not decrease, public expenditures. On the other hand, the difficulties in the assessment and collection of taxes increase rapidly after a certain point is reached. In a city like Baltimore we need twice as much to spend to give us what as a city we need; yet it is evident that our tax rate is already too high. We must, then, if we would keep pace with the world's progress, turn to industrial pursuits for a portion of our public revenues.

Those industrial pursuits which are best adapted to furnish us with revenues are called natural monopolies; and by this we mean that their own inherent properties make them monopolies. There are several important industries which are of this character, but the gas business illustrates them all—perhaps better than any other—because the general principles are in this business so clearly seen. There are those who would have us still believe that competition in the gas business is possible; but surely they are the wildest kind of theorists. What is a theory worth that has not facts back of it? Now, all that I ask is for those who believe that competition in the gas business is a possibility to adduce a single instance of permanent successful competition. Let them dispense with vague generalities and give us facts. Competition has been tried thousands of times, and I defy them to produce the single instance of successful competition. I restrict them to no country and to no clime. They may travel north or south, east or west; they may search Europe, Asia, America; but they will look in vain for successful competition in the gas business. Let us be content with the unvarying testimony of hard facts. Now, there are two ways in which revenue may be derived from natural monopolies. Private parties may pay for the monopolies, or government itself may undertake to operate them. The first method is better than the pursuit of such a Utopia as competition. If people are not willing to consent to public administration, then let private parties pay for monopolistic privileges their full value. These should, however, always be granted for a limited period only, and the right of purchase without payment for franchise reserved. No perpetual franchises should ever be granted. No one is wise enough to say what may be desirable in the future, and the reserved right of purchase of plants of monopolies makes it possible for the nation, state, or or city, to adjust itself to existing conditions. Direct administration by government is, however, preferable. In this case profits accrue to the public, and politics are purified. The following table compares the cost per night of electric lighting in five cities under private management and under municipal ownership of electric lighting plant:

	Private.	City.
Bay City, Mich.....	27.5 cts.	16.0 cts.
Painesville, Ohio.....	19.7 "	10.6 "
Huntingdon, Ind.....	39.0 "	13.7 "
Lewiston, Me.....	50.0 "	14.0 "
Aurora, Ill.....	89.5 "	15.0 "
Average per night.....	45.1 cts.	13.9 cts.

At the last regular monthly meeting of the Directors of the Port Hope (Canada) Gas Company Mayor Burnham resigned his dual seat, as he now is, by virtue of his Mayoralty position, a Director as representative of the stock in the Company owned by the town Mr. James Craick was selected by the Directors to fill the vacancy thus created.

The Board of Aldermen, Hartford, Conn., have decided to equip a testing room for the gas inspector.

The works of the Freeport (Pa) Gas Company will be closed down on or about April 1. The plant is worn out, and the prospects do not justify any expenditure on renewal account.

The plant of the Fayetteville (N. C.) Gas Company has been materially added to. The rosin process of gas making has also been abandoned there, and a local coal is carbonized, which is obtained from Egypt, a village in Yancey county.

At the annual meeting of the Jefferson City (Mo.) Gas and Electric Light Company it was resolved to keep the street lights burning all night during the time of the State re-union of the G. A. R. The Company also offered to furnish gas to the encampment without making any charge therefor. The officers chosen were: President, W. W. Wagner; Vice-President, Louis Schmidt; Secretary, Treasurer, and Superintendent, Charles E. Hess; Directors, W. W. Wagner, H. C. Geisberg, Louis Schmidt, C. E. Hess, and J. C. Fisher.

The rates charged by the Rockville (Conn.) Gas and Electric Light Company for each 1,200-candle power commercial arc light are: One lamp, from dusk until 10 o'clock, on 4 nights of each week, 24 cents per night; two lamps, 22 cents; three lamps, 20 cents. From dusk until 6 o'clock, Tuesday and Thursday evenings, and later than 10 o'clock P.M., at the rate of 5 cents per hour.

A reporter of the St. Louis *Republic* (dated the 11th inst.) is responsible for the following: "St. Louis is destined to be the first city in the country to try fuel gas on a commercial scale. The experiment—for such it will be, though believed to be perfectly certain to succeed—will be made in a few months. Of the details, President McMillin, of the Laclede Gas Company, said yesterday: "Yes, we propose to put fuel gas on the market in a short time, say somewhere about the 1st of June or July. We are fortunately situated for the experiment. We have the water gas plant, which, as it is merely a duplication of the Laclede plant, so far as it goes, is superfluous for the making of illuminating gas, but can be utilized without any important changes for the making of fuel gas and its distribution over the territory covered by the water gas mains. Thus we can save possibly $1,000,000 in the erection of a plant and the laying of pipes. Everything is ready to our hand. It will not take long to find out whether or not we can afford to keep up the making of the gas. Scientifically and mechanically the making of fuel gas is all right. We are certain of our standing; but as to its commercial success we do not yet know. Of course, it is only a question of time—gas is bound to be the fuel of the future; but whether people are now ready to take it in sufficient quantities to warrant us in making it is another thing. We shall sell it at 40 cents a thousand feet. It will cost us, say, 20 cents. That is a profit of 100 per cent. But it is only a profit of 20 cents a thousand feet, after all, and it will take a great many sales at that figure to pay profit on the $1,000,000 or so invested. We shall need a great many consumers, and as it will be a new thing, we cannot be sure that people will take hold of it with sufficient promptness to make it an immediate success. But if we get enough consumers to

warrant it, we shall extend the pipes over the entire city. That will involve an expenditure of a good many million dollars; so, you see, we shall want to adopt Davy Crockett's motto and be sure we are right before we go ahead."

"How many consumers can you get along the line of the water gas pipes?"

"With our customers and those of the water gas company there are probably from 6,500 to 7,000 consumers along the lines of those pipes. If we got one-half of those we should feel encouraged to go ahead. We should canvass for customers, beginning on the outside of that territory, and as fast as we got enough to justify it, would extend the pipes. In that territory are many houses and offices heated by steam, and those we should not expect to get. But in the residence portion of the city we should be able to get many customers. Of course, many people will be only too glad to get fuel gas. But we expect to introduce it slowly. There are from 80,000 to 100,000 houses in St. Louis, yet there are only about 20,000 consumers of illuminating gas in the place, which will probably be a surprise to most people."

"How will the consumption of fuel gas compare with that of illuminating gas as to volume?"

"It will be larger, say from one-third to one-half more will be required in a stove, for instance, because it will not be as rich gas; that is, it will require more of it to give the same heat. That would bring up the price, say, to 60 cents per 1,000 feet, less than half what is now paid, so that consumers could afford to use it lavishly, if necessary."

"Will you use the same quality of coal in making fuel gas that is used in making illuminating quality?"

"No; we shall use, we expect, an Illinois coal that will be entirely used up, not even tar remaining as a residuum."

"You have faith in the fuel gas idea?"

"The greatest faith possible. As I said, there remains now only the question of getting enough customers to make the manufacture profitable—and that will come sooner or later. I am glad that St. Louis is to be the first place to try it on. There is one town—Jackson, Mich.—where they use fuel gas, but that is too small to determine the question of practicability one way or the other. The first experiment of a sufficient commercial scale will be made right here in St. Louis."

THE annual meeting of the stockholders of the New York and Cleveland Gas Coal Company was held in Pittsburgh, about a fortnight ago, when the following Directors were elected: W. P. De Armit, Henry Phipps, Jr., W. H. Berger, Frank Semple, John Walker, J. E. Umbstaetter, J. B. Hamilton, J. T. Colvin, and J. J. Donnell. The officers elected were W. P. DeArmit, President; Frank Semple, Treasurer; and C. L. Dixon. Secretary. In speaking of the years' business, Mr. De Armit said: "The last year has been so unsatisfactory and unprofitable that we are ashamed to have the figures published. The only cause for congratulation is in the fact that we are no worse off than our neighbors, in fact in better shape than some, and the only remedy I know of is to trust to the future to give us better prices for our product and a greater demand for coal." Another stockholder said: "The past year's business was much below that of the year before and we were far from satisfied with the past, and have little to encourage us in the future. As long as natural gas continues to be in such general use and the prices of it continue as they are, there is nothing in the coal business. We have not decided what will be done, but our Board of Directors will no doubt decide on what is best."

HENRY F. MARTIN, chemist to the Board of Health, recently entered complaint in the Court of Special Sessions against Mr. Jas. W. Smith, President, and Frederick Crowell, Superintendent, of the Consolidated Gas Company of this city. Defendants were charged with violating a section of the Sanitary Code, in that they permitted a nuisance to exist. From the station at Forty-fourth street and Eleventh avenue a number of pipes run into the bed of the North River, the pipes acting as carriers of refuse from the works to the river. It was claimed that the stench arising from the matter so deposited endangered the health of people obliged to reside within the affected district, hence Martin's complaint. No defence was interposed, and the Company was fined $250.

BUFFALO, N. Y., pays its Gas Inspector, who is appointed for one year by the City Engineer, at a salary of $1,000, and the passages in the city ordinances defininig his duties are as follows:

Section 5—He shall have supervision over the public lamps and of lighting, cleaning, repairing and extinguishing the same; he shall see that they are kept clean and in good order, and at all times provided with good and sufficient burners of the capacity mentioned in the contract between the city of Buffalo and the gas companies from which it purchases gas, and that such burners are kept free and clean, and pass the amount of gas called for in said contracts; and for that purpose he shall, as often as once every month, make a test of each and every one of such burners with some standard purchased by said city and report the result of such test to the Common Council. He shall daily make a photometrical test of the illuminating power of the gas and make weekly reports thereof to the Common Council.

Section 6—He shall have power and it shall be his duty, to enter every public building owned by the city, to test the meters therein and regulate and control the use of gas in each of said buildings. He shall at the end of each month, examine the meters in each of the public buildings owned by the city, make a record of the number of feet of gas consumed in each of said buildings, and report the same to the Common Council. He shall compare the same with the bills for gas furnished by the different gas companies and no such bill shall be paid until the same shall be certified by the gas inspector.

Section 7.—He shall see that the lamps are kept lit during the whole number of hours specified in the contracts between the city and the gas companies. He shall at the end of each month report to the Comptroller the number of lamps not lit during the current month and the number of hours they were not lit. It shall be the duty of the Comptroller to estimate the amount thereof, and deduct such amount from the estimate of gas furnished the city under its contract.

Surely, if Buffalo's Gas Inspector faithfully carries out these instructions, he may be said to earn his salary.

IN our reference to electric lighting rates at Rockville, Conn., it might also have been said that the contract between the Company and the authorities calls for the maintenance of 74 arcs (1,200 candle power) to be lighted on 300 nights in the year, and to be paid for at the rate of $75 per lamp per annum.

THERE is talk of a gas works for Rapid City, South Dakota.

THE bill regulating the purity of Rhode Island gas, now before the General Assembly of that State, provides that no gas company shall supply in any city or town of the State gas which contains more than 20 grains of sulphur or 10 grains of ammonia per 100 cubic feet of gas, or more than 10 per cent. of carbonic oxide, or any sulphureted hydrogen.

THE annual meeting of the Salem (Mass.) Gas Light Company was notable for its surprises, foremost among which was the refusal of Mr. Wm. H. Jelly, who had been President of the Company for the past 17 years, to accept a re-election. Then an entirely new Board of Directors was chosen in the persons of John W. Leighton, of Boston, John R. Langmaid, H. A. Hale and Edwin Dodge, of Salem, and Geo. F. Sawyer, of Peabody. Mr. David Moore was re-elected Treasurer, and B. W. Sherman was named to succeed himself as Clerk. It is understood that the new management will advocate the operation of an electric lighting plant by the Gas Company, and the change in the Directorate was probably occasioned by a difference of opinion among the shareholders respecting the good policy of such a move. The sendout last year was 44 millions cubic feet, and a good round sum was expended in plant betterment during the twelvemonth.

MONTAGUE HAWK has been appointed meter inspector for the Easton (Pa.) Gas Company, vice Louis Pittenger, resigned.

THE proprietors of the incandescent electric supply of Martinsburg, W. Va., are endeavoring to secure customers on the following basis—the Edison system is used and the lighting value of the lamps is put at 12 candles: For the first light, 75 cents per month; 2d light, 65 cents; 3d light, 50 cents; 4th light, 40 cents; 5th light, 35 cents; 6th and all additional lights, 20 cents. They also offer shopkeepers on the main street, 10 lights for a payment of $3.80 per month, said lights to be burned according to the user's convenience. That Company ought to be in the sheriff's charge before it is much older.

THE Lawrence (Mass.) Gas Company has chosen the following Board of Directors: Geo. L. Davis, Geo. D. Cabot, Chas. A. De Courcey, Chas. M. Seaver, N. H. Emmons, Benjamin Brewster and J. Lewis Stackpole.

THE City Clerk of San Jose, Cal., has been directed to advertise for plans, specifications and bids for lighting the streets of that city with electric lights for a term of 5 years, or less, as the Mayor and Common Council may determine. The successful bidder shall have its machinery and plant erected and in working order at least one month prior to the 30th of September next, the time at which the present contract for lighting the streets expires. The bond required is $5,000.

Gas Stocks.

Quotations by Geo. W. Close, Broke and Dealer in Gas Stocks.

16 Wall St., New York City.

February 24.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	96	—
Central	500,000	50	—	—
" Scrip	220,000	—	—	—
Equitable	4,000,000	100	119	122
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	109	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	42	46
Preferred	5,000,000	100	83	86
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	109	111
Citizens	1,200,000	20	68	70
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	121	124
" Bonds	300,000		100	1·5
Peoples	1,000,000	10	80	82
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	93	96
Nassau	1,000,000	25	115	—
" Ctfs	700,000	1000	120	122
Williamsburgh	1,000,000	50	119	122
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co. —				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	24	25
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	44¾	—
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	94½	94¾
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	97	—
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	99
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	15	25
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1.000,000	50	190	200
Central, S. F., Cal			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	52½	53
" Bonds	6,400,000		107	107½
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	186	190
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	15	16
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	84¾	85½
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			35	35½
Peoples, Jersey City			60	61
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	55½	55¾
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City 268
Wm. Henry White, New York City 271
Wm. Mooney, New York City 268
William Gardner, Pittsburgh, Pa 268
Fred. Bredel, N. Y. City 267

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa 268
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) 268
Ohio Pipe Co., Columbus, Ohio 268
M. J. Drummond, New York City 268
R. D. Wood & Co., Phila., Pa 270
Warren Foundry & Machine Co., New York City 268
Donaldson Iron Co., Emaus, Pa 268
Dennis Long & Company, Louisville, Ky 268

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City 271
Continental Iron Works, Greenpoint, L. I 271
Delly & Fowler, Phila., Pa 271
Kerr Murray Mfg. Co., Fort Wayne, Ind 259
Stacey Mfg. Co., Cincinnati, Ohio 271
Bartlett, Hayward & Co., Baltimore, Md 269
Morris, Tasker & Co., Limited, Phila., Pa 269
Davis & Farnum Mfg Co., Waltham, Mass 223
R. D. Wood & Co., Phila., Pa 270
Bouton Foundry Co., Chicago, Ills 271
Smith & Sayre Manufacturing Co., New York City 270
Fred. Bredel, N. Y. City 267
United Gas Improvement Co., Phila., Pa 261
Henry Pratt & Co., Chicago, Ill 267
National Gas Light and Fuel Co., Chicago, Ills 262
Simpkin & Hillyer, Richmond, Va 256

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills 262
Bartlett, Hayward & Co., Baltimore, Md 269
Wm. Henry White, N. Y. City 271
United Gas Improvement Co., Phila., Pa 261
Henry Pratt & Co., Chicago, Ill 267
The Fuel Gas and Light Improvement Co., N. Y. City 256

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St. Louis, Mo 259

GASHOLDER TANKS.

W. C. Whyte, New York City 262
J. P. Whittier, Brooklyn, N. Y 263

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass 275

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J 266
B Kreischer & Sons, New York City 266
Adam Weber, New York City 266
Laclede Fire Brick Manuf'g Co., St. Louis, Mo 256
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y 266
Burgner & O'Brien, Phila., Pa 266
James Gardner, Jr., Pittsburgh, Pa 266
Henry Maurer & Son, New York city 267
Chicago Retort and Fire Brick Co., Chicago, Ills 266
Baltimore Retort and Fire Brick Co., Baltimore 266
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo 266

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City 260
R. D. Wood & Co., Phila., Pa 270

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md 269
Fred. Bredel, New York City 267
Chicago Retort and Firebrick Co., Chicago, Ills 266
Wm. Henry White, N. Y. City 271
J. H. Gautier & Co., Jersey City, N. J 266

GAS GOVERNORS.

Connelly & Co., New York City 263
Fred. Bredel, N. Y. City 267
Friedrich Lux, London, England 255

SELF-SEALING MOUTHPIECE DOORS.

Smith & Sayre Mfg. Co., New York City 270

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City 224

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y 260

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio 272

GAS METERS.

John J. Griffin & Co., Phila., Pa 274
American Meter Co., New York and Philadelphia 275
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa 275
Helme & McIlhenny, Phila., Pa 17
D. McDonald & Co. Albany, N. Y 17
Nathaniel Tufts, Boston, Mass 274
Maryland Meter and Manufacturing Co., Baltimore, Md 298
John Hillen, Brooklyn, N. Y 275
Bell & Jones, Philadelphia, Pa 274

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind 258
Smith & Sayre Manufacturing Co., New York City 270
Wilbraham Bros., Philadelphia, Pa 263
Connelly & Co., New York City 263

GAS COALS.

Penn Gas Coal Co., Phila., Pa 273
Perkins & Co., New York City 272
Newburgh Orrel Coal Co., Baltimore Md 273
Despard Coal Co., Baltimore, Md 273
Chesapeake and Ohio R. R. Coal Agency, N. Y. City 273
Westmoreland Coal Company, Phila., Pa 273
J. & W. Wood, New York City 272

CANNEL COALS.

Perkins & Co., New York City 272
J. & W. Wood, New York City 272

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y 264
John McLean, New York City 264
Chapman Valve Manufacturing Co., Boston, Mass 264
R. D. Wood & Co., Phila., Pa 270
The P. H. & F. M. Roots Co., Connersville, Ind 258

GAS ENGINES.

Schleicher, Schumm & Co. Phila., Pa 276
Clerk Gas Engine Co., Phila., Pa 264
Van Duzen Gas Engine Co., Cincinnati, Ohio 264

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass 263
Ball Engine Co., Erie, Pa 255
Westinghouse Machine Co., Pittsburgh, Pa 267

GAS LAMPS.

G. Shepard Page, New York City 228
Standard Gas Lamp Co., Phila., Pa 256
Welsbach Incandescent Gas Light Co., Phila., Pa 257
The Siemens-Lungren Company, Philadelphia, Pa 257

PURIFIER SCREENS.

John Cabot, New York City 264
Bartlett, Hayward & Co., Baltimore, Md 264

GAS STOVES.

American Meter Co., New York and Philadelphia 265
The Goodwin Gas Stove and Meter Co., Phila. Pa 240
George M. Clark & Company, Chicago, Ills 257
D. McDonald & Co., Albany, N. Y 266
Maryland Meter and Manufacturing Co., Baltimore, Md 274
Bell & Jones, Philadelphia, Pa 274

STREET LAMPS.

J. G. Miner, Morrisania, New York City 256
Bartlett Street Lamp Man'fg Co., New York City 256

BURNERS.

C. A. Gefrorer, Phila., Pa 272

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City 264

PURIFYING MATERIAL.

Connelly & Co., New York City 263
Friedrich Lux, London, England 255
Edgewater Lime Works, Edgewater, N. J 255

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 273

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City..... 271

SOLVENTS.

Maas & Waldstein, New York City..... 263

BOOKS, ETC.

Gerould's System Gas Bookkeeping..... 255
1889. Directory. 1889 266
King's Treatise..... 268
Scientific Books..... 274
Management of Small Gas Works..... 264
Gas vs. Electricity..... 256
Practical Electric Lighting..... 263
Electric Light Primer..... 263
American Gas Engineer and Superintendents' Handbook... 273
Digest of Gas Law..... 255
Fuel and its Applications..... 255

WANTED,

A young man to act as

Meter Taker and to Make Himself Useful

n a small Gas Works. Must understand gasfitting and be strictly temperate. Address, with references,

768-2 "G.," care this Journal.

POSITION WANTED

As Manager of a Gas Works

Making from 5 to 10 million cubic feet per annum. Six years' experience. Address "J. M. M.,"

767-4 Care this Journal.

POSITION WANTED.

A Mechanical Engineer,

Experienced in Gas Manufacture, wishes a position as Superintendent of a Gas Works. Best of references given and asked. Salary, $1,200.

"MECHANICAL ENGINEER," care this Journal,

765-tf or Box 972, West Bay City, Mich

Position Wanted

As Superintendent or Assistant of a Gas Works,

By a man who can give the best of references. Thoroughly understands the manufacture and distribution of gas and the construction of works. Address

765-5 "M.," care this Journal.

FOR SALE.

We offer the following gas apparatus for sale, delivered f.o.b. cars Fort Worth, Texas:

Two Benches of 3's, with cast iron Hydraulic Main, Dip and Ascension Pipes, and Mouthpieces (14 by 23 in.).

One Bench of 6's, with cast iron Hydraulic Main, Dip and Ascension Pipes, and Mouthpseces (12 by 20 in.)

Two Benches of 3's, with cast iron Hydraulic Main, Dip and Ascension Pipes, and Mouthpieces (14 by 24 in.).

Four Purifiers, 6 ft. by 6 ft., with 6-in. Connections and Center Seal. **Steam Jet Exhauster. One Set Pipe Condensers** 6-in.). **One Upright Scrubber,** 11 ft. high by 36 in. diam., with Bye-Pass. **One Station Meter,** daily capacity 100,000 cu. ft. **One Upright Boiler,** 20 horse power.

All of above apparatus in first-class condition and are so guaranteed. For further particulars address

FORT WORTH LT. AND POWER CO.,

767-4 Fort Worth, Texas.

GAS WORKS FOR SALE.

A CONTROLLING INTEREST IN SEVERAL

Interior California Coal Gas Plants,

now paying handsomely, are offered on very reasonable terms This is an exceptionally good opportunity for practical gas men of limited means, wishing to remove to a mild and healthful climate, to acquire an established and paying business. Particulars given and full investigation solicited.

SECRETARY, 123 Beale Street,

760-3 mos. San Francisco, Cal.

FOR SALE.

A Complete Water Gas Plant.

60,000 Cu. Ft. Daily Capacity.

Fully equipped; all the latest improvements; includes Generator, Purifiers, and Holder. Can be removed to any part of the country, and set up at small cost. For further information apply to BRADFORD GAS LT. & HEATING CO., Dunkirk, N. Y

FOR SALE,

One Hydraulic Main (five sections), wrought iron, 22 by 24, with Bye-Pass on Dip-Pipes.

25 Valves, Stand-Pipes, 7-inch Mouthpieces and Lids, all complete, ready for use, to fit up five benches of 5's.

This apparatus is all in first-class condition.

Price, $800, f.o.b. cars or boat, Poughkeepsie, N. Y.

Inquiries may be sent to this Office.

6 PER CENT.

First Mortgage Bonds

ON GAS WORKS

SITUATED IN GROWING WESTERN TOWNS.

Principal and Interest Guaranteed.

INTEREST SEMI-ANNUALLY.

For sale by the undersigned, who will furnish all necessary information regarding them.

JOS. R. THOMAS, 42 Pine St., N. Y. City.

FRIEDRICH LUX,

Ludwigshafen am Rhein and London.

Lux Mass

GAS GOVERNORS,

Gas Balance.

Fuel and Its Applications.

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, ncluding Mr. F. P. Dewey, of the Smithsonian Inst, Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, **$7.50.**

A. M. CALLENDER & CO., 42 Pine St., N. Y.

GEROULD'S

System Gas Bookkeeping.

Approved and adopted by many of the prominent Gas Engineers of the Country.

Sample Sheets and Price-List furnished free on application to

L. P. GEROULD, - - Mendota Ill.

EDGEWATER LIME WORKS

Chas. F. McKenna, Proprietor.

SHELL LIME.

Lime by the Cargo for Gas Purification.

EDGEWATER, BERGEN CO., N. J.

Write for Testimonials and Prices.

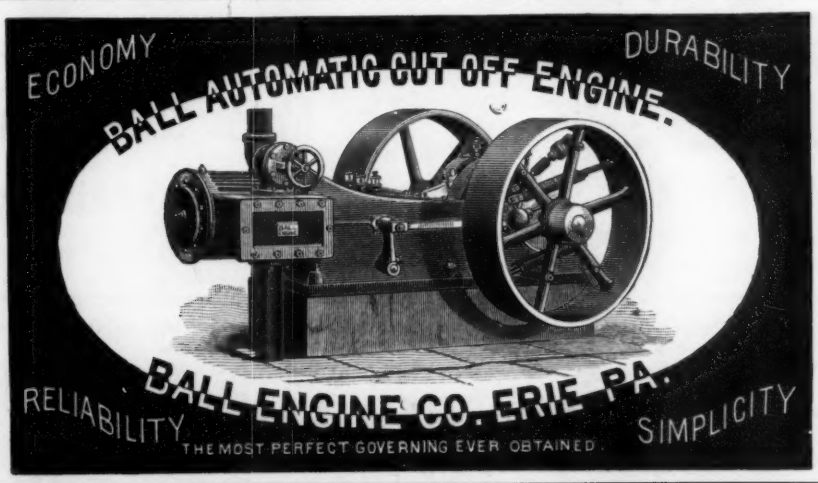
GREENOUGH'S

"DIGEST OF GAS LAW."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO.,
42 Pine Street, N. Y.



GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass.

F. D. HARMON, Pres. CHAS. C. ALLEN, Sec. and Treas. P. W. MACKENZIE, Chief Engr. & Supt.

THE FUEL GAS AND LIGHT IMPROVEMENT CO.

OF AMERICA.

Owners of the RECENT Mackenzie Patents,

For the United States, England, Russia, France, Germany, Austria, and Canada,

No. 32 Park Place, New York City.

This SYSTEM is an ABSOLUTELY NEW DEPARTURE IN THE MANUFACTURE OF FUEL AND ILLUMINATING GAS.

The COST OF GAS IN THE HOLDER by our System is at least THIRTY PER CENT. LESS than that made by any other process of the day.

The Gas is manufactured WHOLLY from LIQUID HYDROCARBONS, such as Lima, Penn, Crude, and Fuel Oils, Naphtha, etc.

Neither PERISHABLE PIPES or other RETORTS, NOR THEIR EQUIVALENTS, are used.

Neither COAL, COKE, nor any other HARD CARBONS enter into the manufacture or composition of the Gas, thereby requiring LESS LABOR THAN ANY OTHER METHOD.

The Gas contains neither SULPHUR nor other impurities, nor is there any resultant LAMPBLACK OR TAR RESIDUUM.

The Gas requires NO PURIFICATION whatever.

The FUEL GAS COSTS VERY MUCH LESS than PURE UNCARBURETED WATER GAS, and contains DOUBLE THE HEAT UNITS.

The APPARATUS is extremely SIMPLE, SUBSTANTIAL, and DURABLE, and consists of a Single Body with a capacity of ONE THOUSAND to ONE HUNDRED THOUSAND cubic feet per hour.

Works may be constructed to run by the CONTINUOUS or ALTERNATING method. If run continuously, the limited amount of Nitrogen present is neutralized by Carbon.

The Gas can be made of a HIGH GRADE for illuminating purposes, of a MEDIUM QUALITY for distribution for domestic purposes, and of a LOW GRADE for manufacturing uses.

Wherever Liquid Hydrocarbons can be had the MACKENZIE PROCESS WILL COMPETE IN PRICE AND SUPPLY ALL THE ADVANTAGES incidental to the use of NATURAL GAS.

This Company desires contracts for the construction of Plants, parts of Plants, Apparatus, Buildings, Holders, and Street Mains, for either of the above purposes, and will Lease or Purchase Works upon satisfactory terms.

Information will be promptly given regarding material required for production of Gas, actual cost of product, cost of works, etc.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

GAS vs. ELECTRIC LIGHT.

We would invite attention to the able and exhaustive argument of General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Company, contained in a handsome pamphlet of 96 pages, entitled

"Edison's Incandescent Electric Lights for Street Illumination. Report of an Argument Delivered by A. Hickenlooper before the Committee on Light, Municipal Council, City of Cincinnati, July 22, 1889."

This is a subject of special interest to all Gas Light Companies.

Prices.

25 copies.....	$7.50	100 copies.....	$22.50
50 copies.....	12.50	250 copies.....	50.00

A sample copy will be sent by mail on receipt of 50 cts

A. M. CALLENDER. & CO., 42 Park St., N. Y. City

No. 29 Champion.

PHILADELPHIA. **NEW YORK.** **CHICAGO.**

STEPHEN A. MORSE, President. EDWIN F. MORSE, Secretary.

GODFREY REBMANN, Vice-Pres. CARLTON M. WILLIAMS, Treas.

STANDARD GAS LAMP CO.,

Main Office, 411 Cherry St. Factory, 1101, 1103, 1105 Frankford Av.

PHILADELPHIA, PA.

It is to the interest of Gas Companies and Cities to double the efficiency of the light on streets by using Dyott's Patent "CHAMPION" LAMPS. They save 50 per cent. over others in cost of repairs, are ornamental, and indestructible except by violence.

Our Patent System of Instantaneously Lighting Gas (without electricity), for Railroad Depots is unequaled.

Dyott's High Candle Power Burner is a very superior lamp where a concentrated and brilliant light is wanted in Hotels, Stores, Depots, etc.

Special Drawings furnished and Estimates cheerfully given, either from Architects', Engineers', or our Draughtmen's Plans.

We manufacture every description of Plain and Ornamental Lamps, Posts, Brackets, Clusters, etc. Correspondence solicited.

Simpkin & Hillyer

RICHMOND, VA.

MANUFACTURERS OF

Gas Works Apparatus

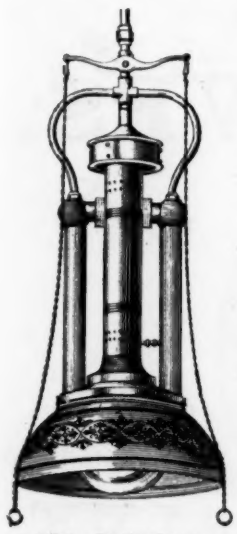
BENCH CASTINGS, CONDENSERS,

Scrubbers, Purifiers, Dry Center Seals,

FOUR-WAY VALVES, GAS VALVES,

SULPHATE OF AMMONIA APPARATUS,
TANKS, ENGINES, BOILERS,
PUMPS, ETC., ETC.

Plans, Specifications and Estimates furnished for new works, or alteration of old works. Correspondence solicited. Works, Newport News, Va.

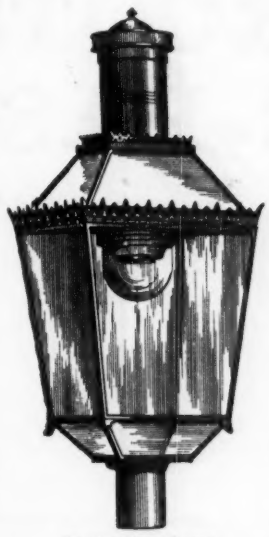

Gordon Portico Lamp.

The Gordon Portico Lamp.

A successful Competitor of the Arc Electric Light for lighting Store Fronts, Show Windows, Depots, Railway Sheds, etc., etc.

The Gordon Street Lamp.

A Successful Competitor of the Arc Electric Light for lighting Streets, etc., etc.


Gordon Street Lamp.

The Lungren Lamp.

A Successful Competitor of the Incandescent Electric Light for Interiors, etc. Is especially applicable for the lighting of Offices, Stores Factories, Mills, Show Windows, Libraries, and all situations where an increased illumination is desired.

More than 25,000 Lungren Lamps are now in use. Testimonials, references, or any desired information will be cheerfully given.

Lungren Lamp.

THE SIEMENS-LUNGREN CO., N.E. Cor. 21st St. & Washington Av., PHILADELPHIA.

WELSBACH SYSTEM
OF
Incandescent Gas Lighting.

OFFICE, DREXEL BUILDING, PHILA., PA.

At the Fall Session of the Board of Supervisors of Winnebago County, held at the County Court House, Oshkosh, Wis., Nov. 26, 1889, the report submitted by Mr. C. W. Cook, Chairman of the Committee on Public Buildings, recommending the use of the Welsbach Incandescent Gas Burner in the Buildings under their charge, was unanimously adopted, because of the extreme economy in the consumption of Gas and the superior character of the light obtained.

JEWEL GAS STOVES

MANUFACTURED BY

GEORGE M. CLARK & COMPANY,

Nos. 157 & 159 Superior Street, - - - Chicago, Ill.

EVERY CONCEIVABLE SIZE AND STYLE,

Ranging in Prices from $1.50 to $30.00.

WE USE NO GAS COCKS.

All Flames are Regulated by a Direct Needle Valve.

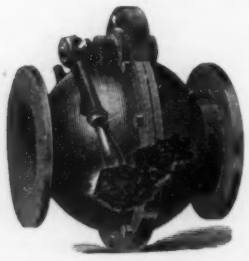
The JEWEL

IS THE

Only Well-Made Gas Stove on the Market.

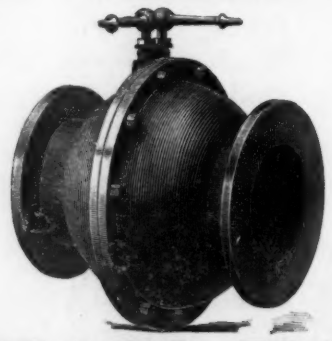
Write for our 1890 Catalogue and see for yourself.

ROOTS'
GAS AND BYE-PASS VALVES.



GAS VALVE

Quick Acting,
Simple,
Efficient, Durable.

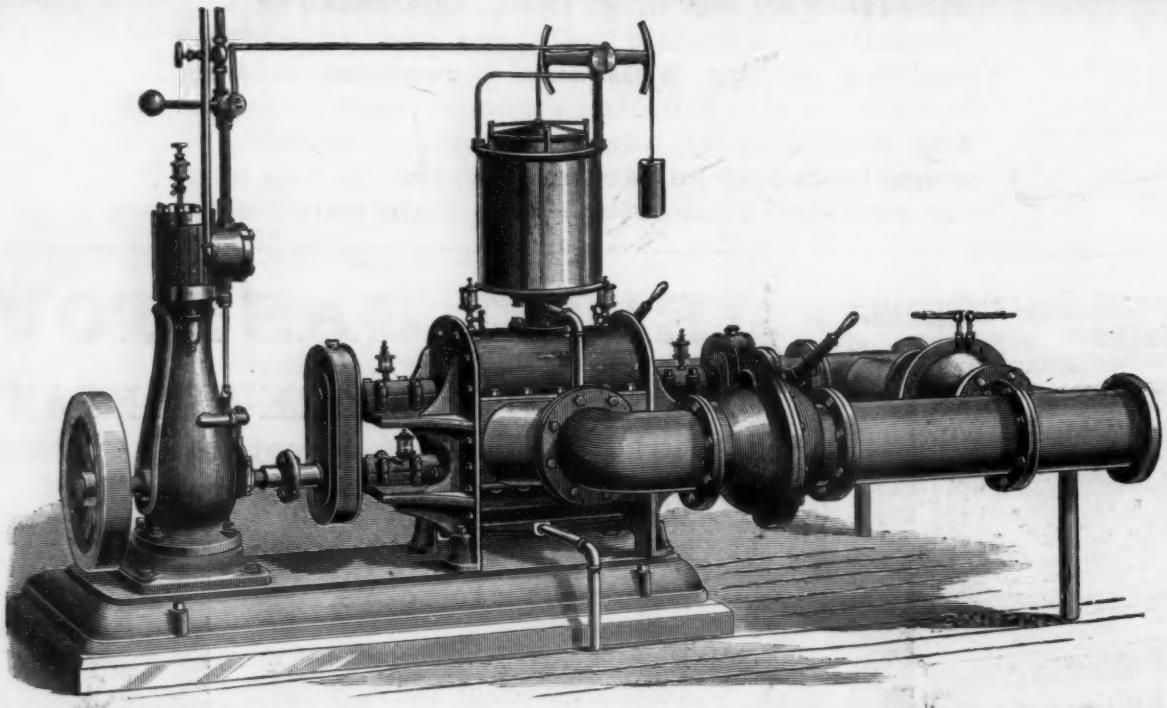


BYE-PASS VALVE.

Automatic Action,
Reliable,
Simple, Durable.

Thousands now in use and giving perfect satisfaction. Write for Catalogue and Prices.

ROOTS'
NEW GAS EXHAUSTER.



We will take pleasure in furnishing estimates on complete plants, including **GAS EXHAUSTER, ENGINE, and GAS GOVERNOR,** all connected, complete, on same bedplate. Also, estimates for **GAS VALVES, BYE-PASS VALVES, and PIPE FITTINGS,** arranged in any manner to suit the exhauster room or main connections.

All flanges of pipe and valve fittings faced off, with bolt holes drilled, all ready to go together.

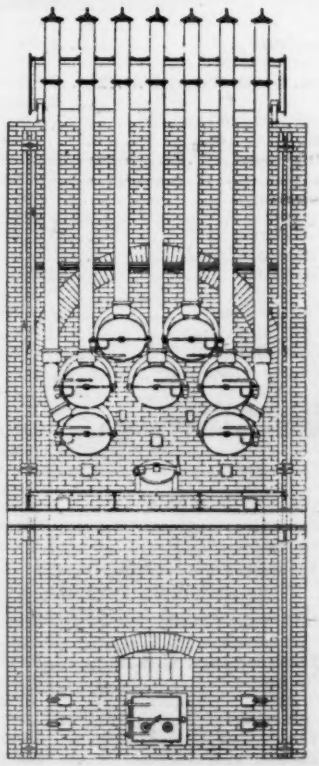
S. S. TOWNSEND, General Agent,
COOKE & CO., Selling Agents,
} 22 Cortlandt St., N. Y.

P. H. & F. M. ROOTS CO., Connersville, Ind.

THIS SPACE
WILL BE
Occupied Next Month by the
KERR MURRAY MFG. CO.
FORT WAYNE, IND.
GAS WORKS
APPARATUS
AND
HOLDERS.

LACLEDE FIRE BRICK MANUFACTURING COMPANY,

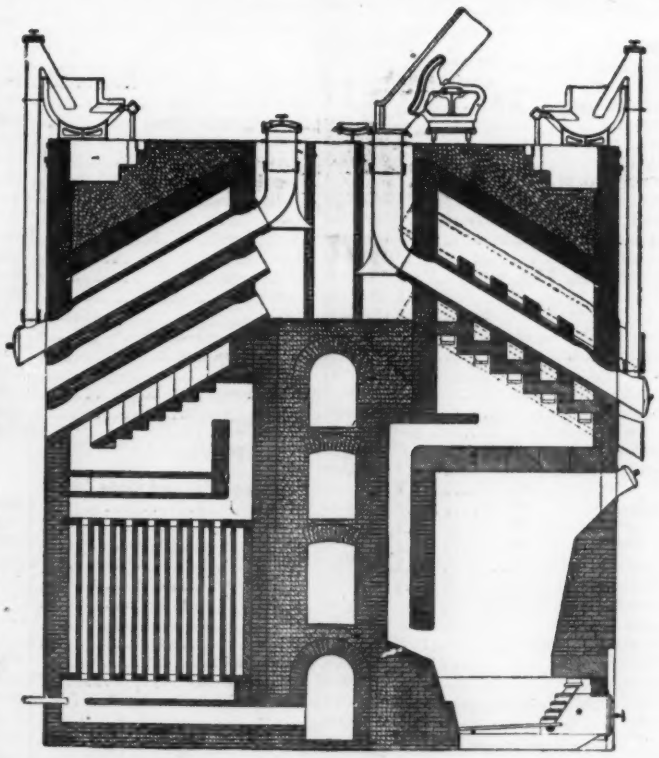
ST. LOUIS, MO.



Exclusive Agents in the United States
FOR THE
Coze System of
Inclined Retorts.

IT IS THE COMING BENCH
FOR MAKING COAL GAS.

It will Save from 50 to 60 per ct. in Labor.



ESTIMATES AND PLANS FURNISHED BY THE
LACLEDE FIRE BRICK MFG. CO., ST. LOUIS, MO.

KIRKHAM, HULETT & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBERS

Erected and in course of construction at present date:

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" **Citizen**	500,000
Brookline, U.S.A	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A	1,000,000
"	1,000,000
" **Nassau**	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A	750,000
Yeadon	500,000
Yeovil	250,000

SOLE AGENT FOR WESTERN HEMISPHERE,

GEO. SHEPARD PAGE. 69 WALL STREET. NEW YORK.

THE UNITED

GAS IMPROVEMENT CO.

DREXEL BUILDING, PHILADELPHIA.

OFFICERS:

WILLIAM W. GIBBS, President.
GEORGE PHILLER, Vice-President.
SAM'L T. BODINE, Gen'l Manager.
RANDAL MORGAN, Gen'l Counsel.

EDWARD C. LEE, Sec'y and Treas.
ALEX. C. HUMPHREYS, Gen'l Supt.
WALTON CLARK, Ass't Gen'l Supt.
H. H. EDGERTON, Chem. and Eng'r.

DIRECTORS:

GEORGE PHILLER,
THOMAS DOLAN
HENRY C. GIBSON,
WM. T. CARTER,
WILLIAM G. WARDEN,
SAM'L T. BODINE.

BUILDERS, LESSEES AND PURCHASERS OF

GAS WORKS.

Orders solicited from Large Cities, Small Towns, Mills, Institutions, from all who want more Light for Less Money.

NATIONAL GAS LIGHT AND FUEL COMPANY,

No. 218 La Salle Street, Chicago.

THE SPRINGER SYSTEM

OF

Fuel and Illuminating Water Gas Works.

REFERENCES.

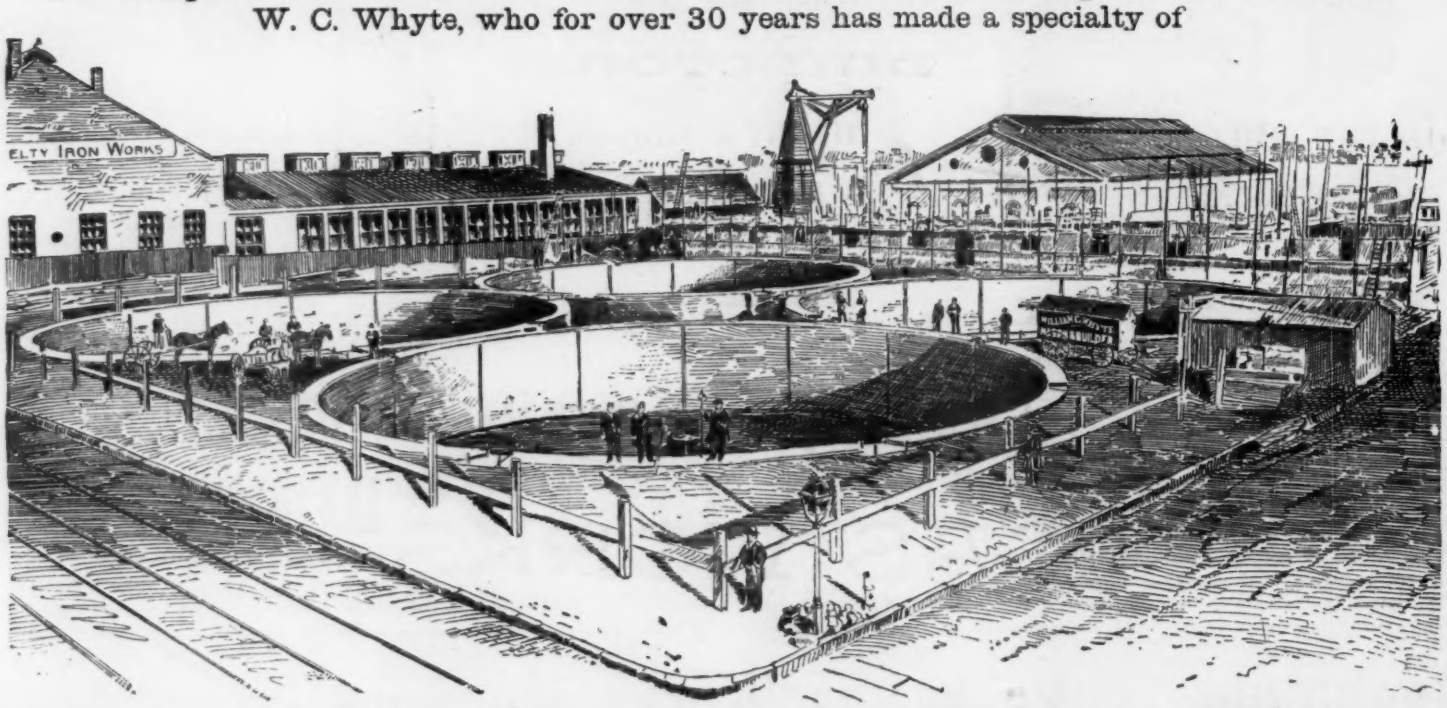
People's Gas Lt. & Coke Co.	Chicago, Ill.
Illinois Light, Heat & Power Co.	Chicago, Ill
Elgin National Watch Co.	Elgin, Ill.
C. R. I. & P. R. R. Shops	Chicago, Ill.
Decatur Gas Lt & Coke Co.	Decatur, Ill.
Niles Gas Light Co	Niles, Mich.
Newton Illuminating Co.	Newton, Kansas.
Wellington Light & Heat Co.	Wellington, Kansas.
Chippewa Falls Gas Lt. Co.	Chippewa Falls, Wis.
Elkhart Gas L.t & Coke Co.	Elkhart, Ind.
Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co	Salina, Kansas.
The Rathbun Co	Deseronto, Prov. Ont.
Jefferson City Gas Lt. Co	Jefferson City, Mo.
Mankato Gas Light Co	Mankato, Minn.
Lima Gas Light Co.	Lima, Ohio.
Minneapolis Gas Light and Coke Co.	Minneapolis, Minn.
Bellevue Water and Fuel Gas Light Co.	Bellevue, Campbell County, Ky.
Bucyrus Gas Lt. & Fuel Co.	Bucyrus, Ohio.
Morris Gas Co.	Morris, Ill.
Los Angeles Gas Co.	Los Angeles, Cal.
San Diego Gas Fuel & Electric Lt. Co	San Diego, Cal.
Sioux Falls Gas Co.	Sioux Falls, Dak.
Dakota Gas and Fuel Co.	Grand Forks, Dak.
St. Johns Mutual Gas Co.	St. Johns, Mich.
Stillwater Gas Light Co.	Stillwater, Minn.
St. Paul Gas Light Co	St. Paul, Minn.
Emporia Electric and Gas Light Co.	Emporia, Kas.
Van Wert Gas Light Co.	Van Wert, Ohio.
Lansing Gas Light Co.	Lansing, Mich.
San Francisco Gas Lt. Co.	San Francisco, Cal.
Shelbyville Gas Light Co.	Shelbyville, Ind.
Great Falls Gas Light Co.	Great Falls, N. H.
Belleville Gas Co.	Belleville, Ontario
Rochester Lt. and Fuel Co.	Rochester, Minn.
Northwestern Gas Light and Coke Co.	Evanston, Ill.
Lincoln Gas Light Co	Lincoln, Neb.
Davenport Gas Light Co	Davenport, Iowa.
Municipal Gas Co	Albany, N. Y.
Alliance Gas Light Co	Alliance, Ohio.
New Gas Light Co	Janesville, Wis.
Chicago Gas Lt. & Coke Co.	Chicago, Ill.
Joliet Gas Co	Joliet, Ills.
Superior Light & Fuel Co.	Superior, Wis.
Kewanee Gas Light Co	Kewanee, Ill.
Aberdeen Light & Fuel Co.	Aberdeen, So. Dak.
Pierre Light and Fuel Co.	Pierre, So. Dak.
*Standard Gas Light Co	New York City.
*Carlinville Gas Light Co.	Carlinville, Ill.

*Building.

GUARANTEED ESTIMATES of Cost of Gas Furnished on Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City

CONNELLY & CO.,

SOLE MANUFACTURERS OF THEIR PATENTED SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

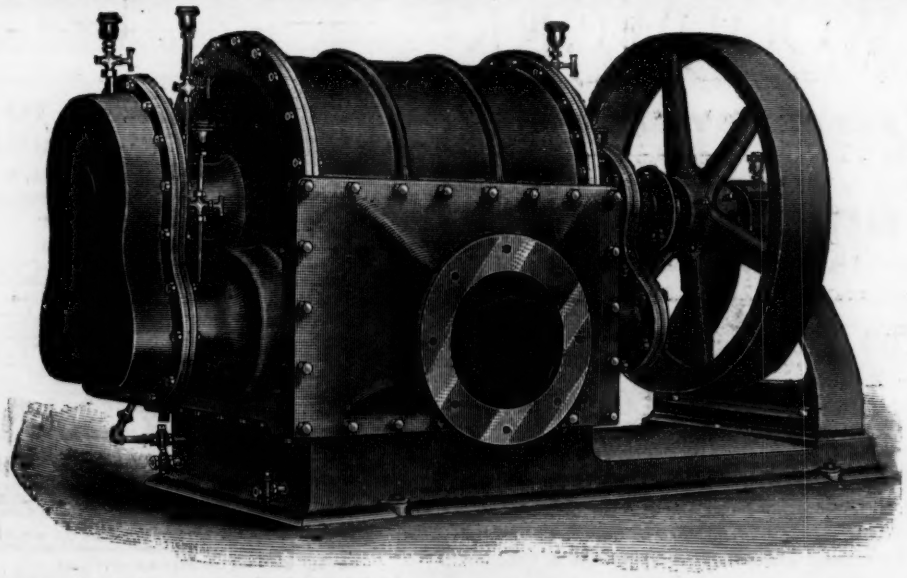
AUTOMATIC GOVERNOR. Has been on the market but *three years*, and in that time has been introduced *more generally* than any invention ever designed for use in gas works. Over *two hundred* of them now in use. Sensitive; reliable; perfectly automatic; reduces leakage; satisfies consumers, and gives great relief to the Manager. No gas works is *complete* without one of these machines.

STEAM JET EXHAUSTER. Designed particularly for small works Combines Exhaust Tube, Steam Governor Gas Compensator, and Bye-Pass Valves in the most compact form possible; occupies but little space; uses very little steam; operated by ordinary workmen; saves formation of carbon in retorts; increases yield 10 to 15 per cent. Specially adapted for *mixing air* with oil gas. *No works* too small to use them profitably.

Prices given on all our specialties *delivered at any point in the United States.* Correspondence solicited.

CONNELLY & CO., No. 111 Broadway, New York City.

WILBRAHAM GAS EXHAUSTER



WILBRAHAM BROS.,

PHILADELPHIA, PA.

JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Practical Electric Lighting

By A. BROMLEY HOLMES, A.M.I.C.E.

With 87 Illustrations. Third Edition. **Price, $1.00.**

Electric Light Primer.

By CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 42 Pine St., N.Y

(Patented.) **IMPORTANT!** (Patented)

NEW SOLVENT FOR GAS PIPE DEPOSITS.

Economical and Effective.

MAAS & WALDSTEIN, 44 Trinity Place and 81 Greenwich St., N. Y.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, - - 499 Wythe Av., Brooklyn, N. Y.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

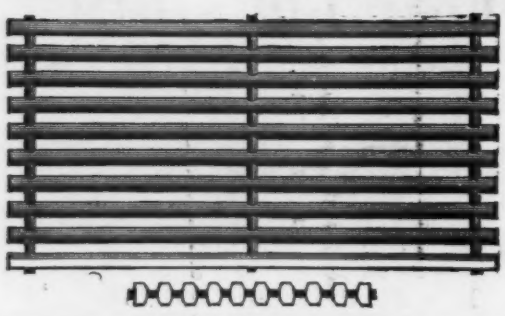
PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON. Supt., 33 & 35 Liberty St., N.Y.

MILLS' REVERSIBLE LIME TRAY,



AND

WOODWORK

Of Every Description

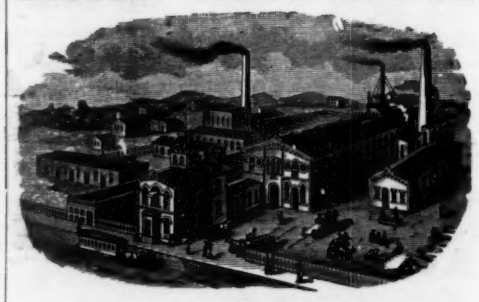
NEEDED BY GAS WORKS.

SEND FOR CIRCULAR AND PRICE LIST TO

BARTLETT, HAYWARD & CO.,

Pratt and Scott Streets, Baltimore, Md.

LUDLOW VALVE MFG. CO.

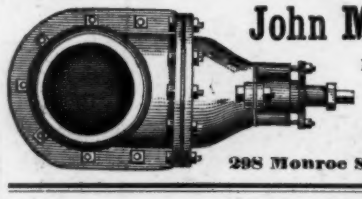


OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av., TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.



John McLean

Man'facturer

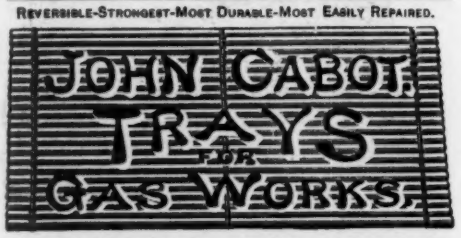
GAS VALVES.

298 Monroe Street, N. Y.

SPECIAL TRAYS FOR IRON SPONGE OR OXIDE OF IRON.

CHURCH'S TRAYS A SPECIALTY.

REVERSIBLE-STRONGEST-MOST DURABLE-MOST EASILY REPAIRED.



306-310 ELEVENTH AVENUE, NEW YORK.

WE ALSO MAKE THE CHEAPEST AND STRONGEST REVERSIBLE BOLTED TRAYS IN THE MARKET.

VAN DUZEN GAS & GASOLINE ENGINE

OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.

RELIABLE AND ECONOMICAL.

Fully Warranted

VAN DUZEN Gas & Gasoline Engine Co. 49 E. 2d St., Cincinnati, O.

A. MacKinnon Machine Co., Agts., 22 Warren St., N.Y.

The Management of Small Gas Works.

BY C. J. R. HUMPHREYS.

Price, $1.

Orders to be sent to A. M. CALLENDER & CO., 42 PINE STREET, NEW YORK.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

Made in Sizes of 5 10 15 20, and 25 Horse-Power. All Engines Guaranteed for One Year.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.,

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter

GAS METERS,

Station Meters,

METER PROVERS, PHOTOMETERS,

PRESSURE GAUGES OF ALL KINDS,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

GAS STOVES FOR HEATING AND COOKING

Sole Agents in the United States for

Verity's Patent Gas Fires.

Circulars and Price Lists on Application.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No 242 Sixth Avenue, New York City.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

J. H. GAUTIER. C. E. GREGORY. C. E. GAUTIER.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire-Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y.

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block, PITTSBURGH, PA. P. O. Box 373.

Fire Clay Goods for Gas Works.

H. A. NORTON, No. 4 CENTRAL STREET, BOSTON, MASS., Agent for the New England States.

GEO. C. HICKS, Prest. **CHICAGO** CHAS. A. REED, Sec. & Treas.

Retort and Fire Brick Co.,

MANUFACTURERS OF

Fire Clay Goods of all Kinds,

AND BEST QUALITY ONLY.

Regenerative Furnaces & Water Gas Goods.

45th St., Clark to La Salle, Chicago.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agent, H. T. GEROULD, Mendota, Ill.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE: { Merchants-Laclede Bldg., Rooms 307 & 308, Broadway and Locust Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of materials for

GAS COMPANIES.

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying.

We furnish and build Half-Depth or Full REGENERATOR FURNACES of different kinds and most approved styles.

Correspondence solicited.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles,

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

1889 DIRECTORY 1889

OF THE GAS LIGHT COMPANIES of the UNITED STATES & CANADA.

Price, - - - - - - - $8.00.

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

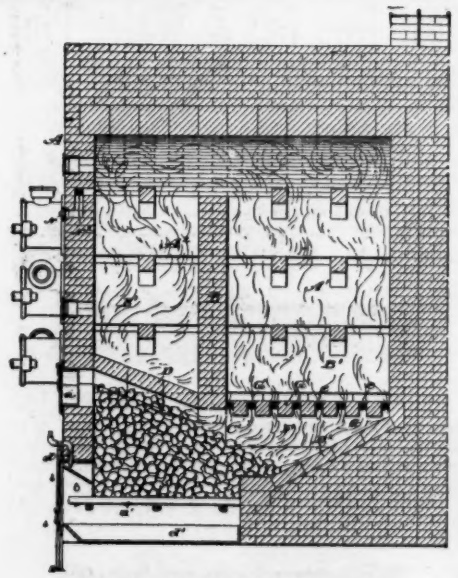
Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

FRED. BREDEL,

CONTRACTOR FOR THE COMPLETE

Erection and Equipment of Gas Works.

SOLE PROPRIETOR OF THE

KLOENNE PATENTS

FOR NORTH AMERICA.

REGENERATIVE FURNACES.

(900 Retorts are now fired in America by the Kloenne-Bredel System.)

SELF-SEALING MOUTHPIECES.

(Over 800 Now in Use.)

Standard Condensers. Washer-Scrubbers.

TAR WASHERS FOR WATER GAS PLANTS.

(In use in the works of the Chicago Gas Lt. Co.)

GASHOLDERS.

Bredel's Automatic Gas Governor.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J.; Mr E. G. Cowdery, Milwaukee, Wis.; and Mr. Theo. Forstall, Chicago, Ills. For further infomation, address

FRED. BREDEL,

No. 208 East Seventeenth Street, N. Y. City.

Plans and Estimates Furnished for New Works or for the Alteration of Old Works.

HENRY PRATT & CO.,

BUILDERS OF THE

PRATT & RYAN WATER GAS GENERATORS,

Arranged to Use Either Crude Oil or Naphtha.

Condensers, Scrubbers, Purifiers, and all Apparatus for Coal or Water Gas.

IRON ROOFS, BOILERS, TANKS, ETC.

Orders and Correspondence Solicited.

Office and Works,
869 to 875
So. Halsted St.
CHICAGO, ILL.

COMPOUND Condensing or Non-Condensing.
16 SIZES, 5 to 500 H. P.
Not yet equaled by any form of Engine for
HIGH FUEL DUTY AND SIMPLICITY.

STANDARD 13 Sizes in Stock. 5 to 250 H. P.
3000 in use in all parts of the Civilized World.

JUNIOR 6 Sizes in Stock, 5 to 50 H. P.
An Automatic Engine cheaper than a Slide Valve.
WELL BUILT. ECONOMICAL. RELIABLE.
Over 300 Sold the First Year.

All the above built strictly to Gauge with INTERCHANGEABLE PARTS.
REPAIRS CARRIED IN STOCK.
SEND FOR ILLUSTRATED CATALOGUES.

WESTINGHOUSE ENGINES
The Westinghouse Machine Co.
PITTSBURGH, PA. U.S.A.

SELLING DEPARTMENT IN THE UNITED STATES.

New York, Boston, Pittsburgh, Chicago,	17 Cortlandt St. Hathaway Building, Westinghouse Build'g, 156, 158 Lake St.	Westinghouse, Church, Kerr & Co.
Philadelphia,	608 Chestnut St.	M. R. Muckle, Jr. & Co.

ST. LOUIS,
511 NORTH FOURTH ST.,
Westinghouse, Church, Kerr & Co.

Salt Lake City, Butte, Mont.	259 S. Main St. Granite St.	Utah & Montana Machinery Co.
San Francisco, Portland, Or.	21, 23 Fremont Street, 33, 35 N. Front St.	Parke & Lacy Co. Parke & Lacy Mch. Co.
Charlotte, N. C. Atlanta, Ga.	36 College St. 45 S. Prior St.	The D. A. Tompkins Co.
Dallas, Tex.		Keating Imp. & Machine Co.
Chattanooga, Tenn.,		C. E. James & Co.

GAS AND WATER PIPES. GAS AND WATER PIPES. ENGINEERS.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Tre

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

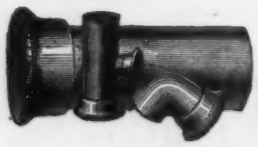
GLOUCESTER IRON WORKS,
GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office, Rooms 61 and 63 Bullitt Building, 131 S. 4th St., Phila., Pa.

WARREN FOUNDRY AND MACHINE CO.

Established 1856. Works at Phillipsburgh, N. J.



New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM TWO TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

DENNIS LONG & COMPANY,

LOUISVILLE, KY.,

Manufacture Exclusively

CAST IRON GAS & WATER PIPE & SPECIAL CASTINGS
OF ALL SIZES.

King's Treatise on Coal Gas.

A stan ard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting thereform; treating also of the Gas Engine, and of Gas Cooking and Heating Appliances.

In 3 Vols. Price per Vol., $10. Sold either by Volume or in Sets.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd.
and READING FOUNDRY CO., Ltd.
Reading, Pa.

Specials—Flange Pipe, Valves and Hydrants
Lamp Posts, Retorts, etc.
General Foundry and Machine Work.
JOHN FOX, Selling Agent. 160 Broadway, N.Y.

THE OHIO PIPE COMPANY,
MANUFACTURERS OF
Cast Iron Gas & Water Pipe,
BRANCH AND SPECIAL CASTINGS.
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.
GENERAL FOUNDERS AND MACHINISTS.
Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.
Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.

JOS. R. THOMAS,
No. 42 Pine Street, N.Y. City.
CONSULTING AND CONSTRUCTING
Gas Engineer and Contractor.
PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.
Contracts taken for all Appliances required at a Gas Works,
Either for New Works or Extensions to Old Plants.

WM. MOONEY
(Successor to WM. FARMER)
No. 94 Liberty St., N Y. City.
GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS WORKS, OR APPARATUS OF ANY CAPACITY.
Plans and Specifications Furnished.

WM. GARDNER,
Gas Engineer,
Lewis Block, Room 20, Pittsburgh, Pa.
Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find it to their interest to open correspondence with the above. Plans mad and estimates furnished.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

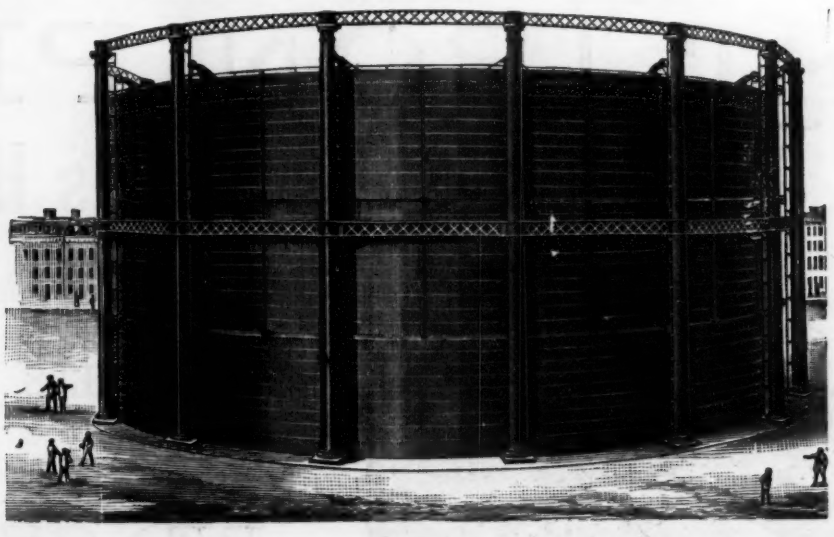
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

HAZELTON BOILERS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,

Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works, MILLVILLE, FLORENCE, and CAMDEN, N. J.

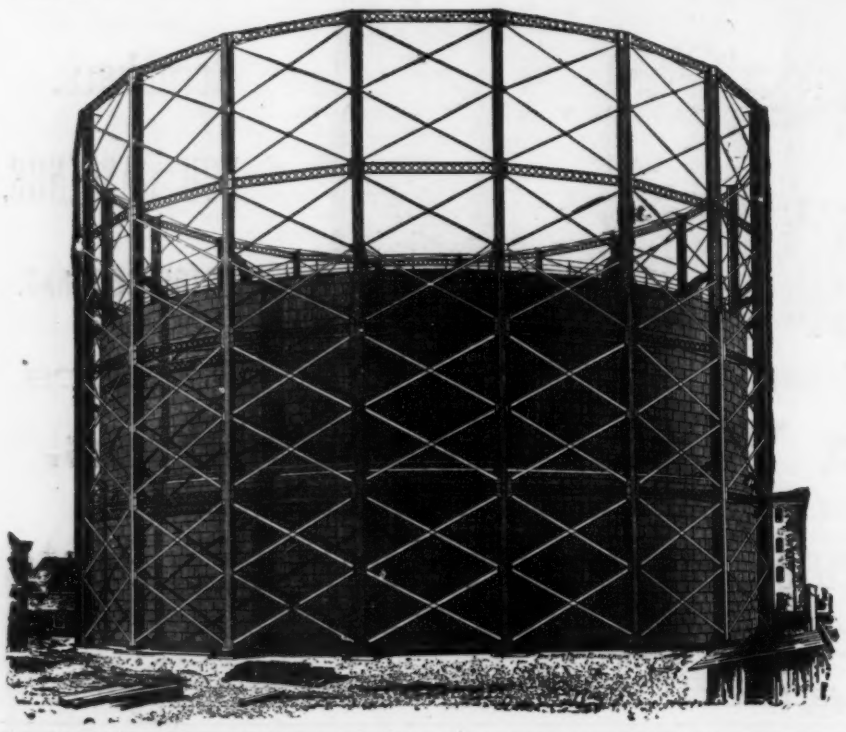
R. D. WOOD & CO.,

Engineers, Iron Founders, and Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH OR WITHOUT WROUGHT IRON OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

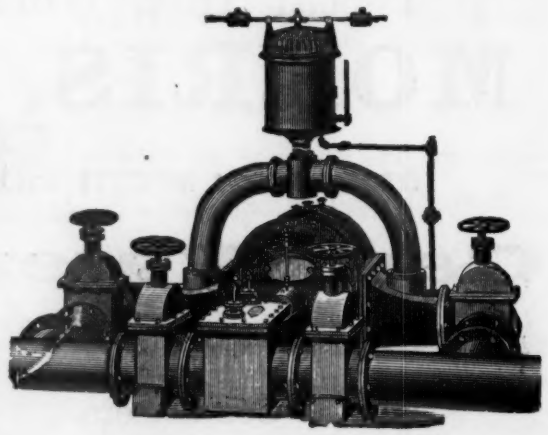
SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

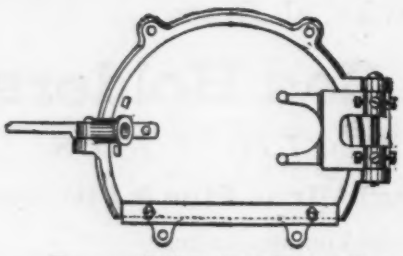
Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.



THE BRENNER SELF-SEALING RETORT DOOR.

Simple, Strong, and Durable.

CLOSES ABSOLUTELY TIGHT & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.



Brenner Self-Sealing Retort Door.

BUILT BY

SMITH & SAYRE MFG. CO.,

No. 245 Broadway, - - - - New York City.

WILLIAM B. LUNDIE, Superintendent of the 42d Street Station of the Consolidated Gas Company, of New York, writes, under date of Jan. 4, 1889:

"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

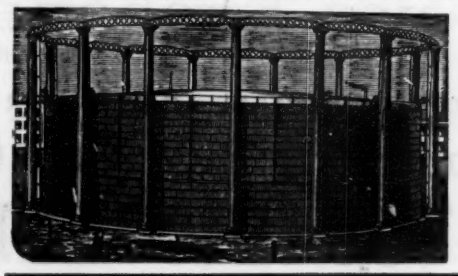
Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

CONTINENTAL IRON WORKS.

THOS. F. ROWLAND, Prest. WARREN E. HILL and CHAS. H. CORBETT, V-Prests. THOS. F. ROWLAND, JR., Sec. & Tr



P. O. Station G., BROOKLYN, N. Y.

ENGINEERS AND MANUFACTURERS OF

Gas Holders

CONDENSERS, SCRUBBERS, VALVES,

PURIFIERS, SELF-SEALING RETORT LIDS

Hydraulic Mains,

And all other articles connected with the manufacture and distribution of Gas.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry:
33, 35, 37 & 39 Mill Street.

Wrought Iron Works:
16, 18, 20, 22, 24 & 26 Ramsey Street:

Cincinnati, Ohio.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS, LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

1842. **DEILY & FOWLER,** 1889.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1884 to 1888, Inclusive:

Newport, R. I.	Long Island City, N. Y.	Port Chester, N. Y.	Malden, Mass.	West Chester, Pa. (2d
Portland, Oregon.	Macon, Ga.	New Rochelle, N. Y.	Paducah, Ky.	Lancaster, Pa. (3d)
Allegheny, Pa. (3d.)	York, Pa.	Salem, N. J. (3d)	Norwich, Conn.	Tacony, Pa. (two)
Atlanta, Ga. (2d.)	Chester, Pa.	Omaha, Neb. (2d)	Seattle, W. T.	Mount Vernon, N. Y.
N.Y.City (Central Gas Co)	Hazleton, Pa. (2d.)	Lynn, Mass. (2d)	San Diego, Cal.	Binghamton, N. Y.
Lynchburg, Va. (2d.)	Staten Island, N. Y.	Little Rock, Ark.	Northern Gas Lt. Co., of	Concord, N. H.
Saylesville, R. I.	Saugerties, N. Y.	Irvington, N. Y.	New York, N. Y.	Dover, Del. (2d)
Rondout, N. Y.	Clinton, Mass. (Lan. Mills)	South Boston, Mass.	Westerly, R. I.	Calais, Me.
Atlantic City, N. J.	Chattanooga, Tenn.	Rye, N. Y. (2)	Willimantic, Conn	New London, Conn. (2d)
Augusta, Ga.	Galveston, Texas. (3d.)	Woodstock, Ont.	Montclair, N. J.	West Chester, N. Y.
Waltham, Mass. (2)	Omaha, Neb.	Malden, Mass.	Attleboro, Mass.	Bay Shore, L. I.
Mahanoy City, Pa.	Fort Plain, N. Y.	Staten Island, N. Y. (2d)	Santa Cruz, Cal.	Washington, D. C.
New Castle, Pa.	Brunswick, Ga.	Woodstock, Ont.	Erie, Pa. (3d)	

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

Erection and Extension of Gas, Water, and Electric Light Works.

SOLE REPRESENTATIVE OF THE

McILHENNY REGENERATOR FURNACE PATENTS

And the Martin Water Gas Process.

Edison Incandescent and American Arc Electric Light Plants Installed.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

Also, SOLE AGENTS for the

BRECKENRIDGE CANNEL,

OF KENTUCKY.

Within the past two years we have delivered this Cannel to over ONE HUNDRED COMPANIES IN THIRTY-THREE DIFFERENT STATES, and it is now in use in some of the large Gas Works

On the Continent and in South America,

where it successfully competes with the Australian Shale. It is the ONLY AMERICAN GAS CANNEL of sufficiently high grade to warrant EXPORTATION TO EUROPE AND SOUTH AMERICA, and it is the only economical substitute for OIL OR NAPHTHA. ONE GROSS TON will produce

10,000 Cubic Feet of 75 Candle Gas,
or 12,500 " " 60 " "
or 15,000 " " 50 " "
} equal to { 750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds

This is the ONLY GAS CANNEL that will produce a REALLY MERCHANTABLE COKE. It can be delivered in parcels of one carload or more to any point in the United States or Canada. Cargo shipments of any size required can be made from NEW YORK, PHILADELPHIA, BALTIMORE, or NEWPORT NEWS. Samples will be sent and particulars of price, etc., forwarded upon application to above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the BATHVILLE COLLIERIES (which produce the celebrated BOGHEAD CANNEL), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Also, WEST FAIRMONT GAS COAL, of W. Va.

Analyses, prices, and all further information furnished on application to

Agency for U.S., Room 93, Nos. 2 & 4 Stone St., N.Y. City.

The Standard Oil Company,

REFINERS OF

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order CAP BURNERS to burn any amoun under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N 8th Street, Phila., Pa.

COKE CRUSHERS.

Newburgh Orrel Coal and Coke Co.

MINERS AND SHIPPERS OF

STEAM, SMITHING, AND GAS COALS,

Foundry and Crushed Coke.

Home Office, 33 S. Gay Street, Baltimore, Md.

J. HARRY LEE, President.

Shipping Wharves, Locust Point, Baltimore.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 225 E. German St., " "

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston.

Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.

By GEORGE LUNGE. Price $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.

A. M. CALLENDER & CO.,
42 PINE ST., N. Y. CITY

GAS COALS. GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City.

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The American Gas Engineer and Superintendent's Handbook.

By WILLIAM MOONEY.

Consisting of Rules, Reference Tables, and Original Matter Pertaining to the Manufacture, Manipulation, and Distribution of Illuminating Gas.

350 Pages, Full Gilt Morroco. Price, by Mail, $3.00.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

GAS METERS. GAS METERS. GAS METERS.

ESTABLISHED 1859.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517, & 1519 Race St., PHILADELPHIA.
No. 52 Dey Street, NEW YORK. No. 75 North Clinton Street, CHICAGO.

Manufacturers of Meters for Measuring Gas

IN ANY VOLUME.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Provers, Gauges, Registers, Etc.

Careful and Prompt Attention paid to the Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

HAROLD J. BELL. S. LEWIS JONES.

BELL & JONES,

No. 12 North Ninth Street, Philadelphia, Pa. Works at Royersford, Pa.

MANUFACTURERS OF

GAS METERS, STATION AND EXPERIMENTAL METERS,

Meter Provers, Pressure Gauges, and All Other Gas Appliances in Our Line.

WE REPAIR ALL KINDS AND MAKES OF METERS, AND THE WORK GUARANTEED.

High Pressure Meters for Natural Gas, in Iron Cases, guaranteed to stand 300 lbs. Pressure. Gas Cooking and Heating Stoves, Hot Plates, Cake Griddles, Waffle Bakers, Boiling Stoves, Laundry and Tailors' Iron Heaters. Hotel and Cafe Ranges a Specialty.

Correspondence Solicited. **Estimates Furnished.**

SCIENTIFIC BOOKS.

All books forwarded by express, upon receipt of price; if sent by mail, postage must be added to price given. We take pains in forwarding any other Works desired. Remittances by check, draft, or P.O. money order.

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.00.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION, with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDRIDGE. 40 cents.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE. 40 cents.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM. 8vo., Cloth. $3

GAS COMPANIES DIRECTORY. $3.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

DIGEST OF GAS LAW. $5.

GAS ENGINE INDICATOR DIAGRAM. by W. E. AYRTON. Paper. 20 cents.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H. ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

A. M. CALLENDER & CO., 42 Pine Street, New York.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

WM WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, Vice-Prest. S. L. JONES, Sec. S. V. MERRICK, Supt.

THE GOODWIN GAS STOVE AND METER CO.,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 142 Chambers St., New York City. 76 Dearborn, St., Chicago, Ills.

WALDO BROTHERS, Agents, 88 Water Streets, Boston, Mass.

MANUFACTURERS OF

DRY AND WET GAS METERS,

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc. Meter Provers (sizes 2, 5, and 10 feet), Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6, and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Center Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete. Also, Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Manufacturers of the "SUN DIAL" GAS STOVES, for Cooking and Heating.

Goodwin's Improved Lowe's Jet Photometer. **Agents for Bray's Patent Gas Burners and Lanterns.**

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.

G. B. EDWARDS, Manager, New York. **S. S. STRATTON, Manager, Chicago.**

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (32 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

GAS INTO POWER,

BY THE

OTTO GAS ENGINE.

GAS POWER.—A Source of Revenue to Gas Companies ready to engage in Electric Lighting, building of Water Works, Electric Street Railways, etc.

Coal for producing Gas is less in amount than that for producing Steam, both being measured on an equal amount of work performed. And, further, with Gas,

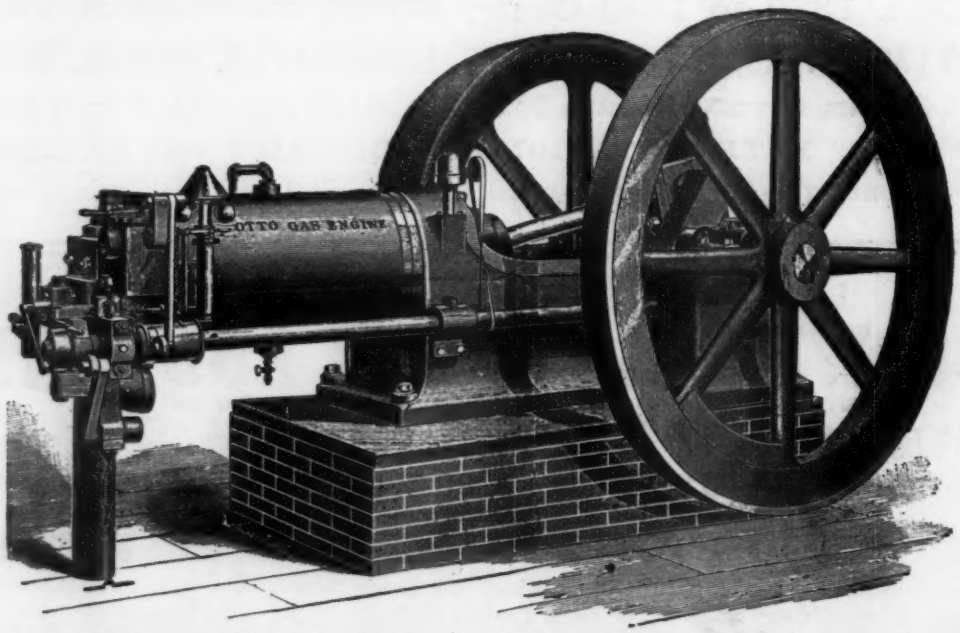
50 to 90 per Cent. of Value of Coal is Returned

by sale of Coke and Tar, according to the market value of these products.

Labor for handling fuel is **reduced,** by its becoming centralized and confined to the gas house, and frequently has not increased after the addition of a power station.

With Gas Power, **cost of fuel** is strictly **limited** to the time of use.

MANY VALUABLE AND RECENT IMPROVEMENTS.



SIZES, 1-3 to 100 HORSE POWER.

Wherever Gas Companies tried Gas Power with Steam Power together in one Station, the use of Steam was subsequently abandoned or restricted, and Gas Power made to take its place.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

Gas Power the Leading Power of To-Day,

AND SOLVE AT ONCE THE QUESTION OF FUEL GAS.

"Otto Gas Engine Works,"

SCHLEICHER, SCHUMM & CO.,

151 Monroe St. (Kent Building), Chicago. **33d and Walnut Sts., Phila.**

NEW YORK AGENCY, 18 VESEY STREET.